# HS2P
## (Machine Code: G407/G408/G410/G411)

# Service Manual

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Ricoh Co., Ltd

# ⚠IMPORTANT SAFETY NOTICES

1. Before disassembling or assembling parts of the scanner and peripherals, make sure that the scanner power cord is unplugged.
2. The wall outlet should be near the scanner and easily accessible.
3. The output voltage of the PSU (Power Supply Unit) can be either 100 ~ 120 Vac or 220 ~ 240 Vac, without any adjustment. Make sure that the above voltage is used.
4. The power cord should be an approved type, in accordance with the regulations for the country in which the scanner is used.
5. The use of cables other than the shield I/O cables or equivalent specified will invalidate the certification of this scanner and may cause interference levels which exceed the limits established for this equipment.

**Maintenance Information**
The user's manual explains how to use and maintain the scanner. Before performing the maintenance, read the user's manual.

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**Notice**
The contents of this manual are subject to change without notice.

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# 1. OVERALL MACHINE INFORMATION

## 1.1 SPECIFICATIONS

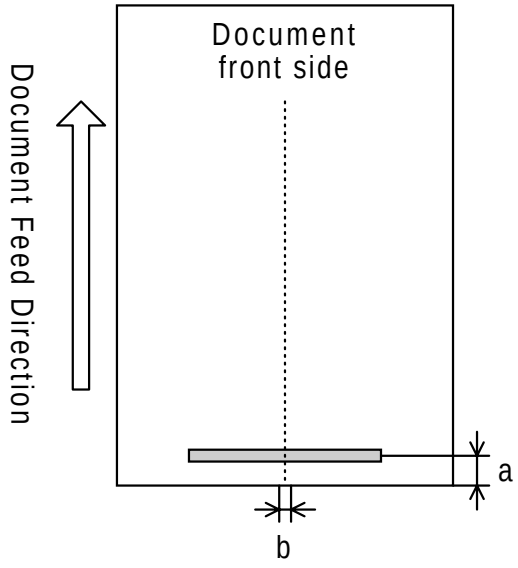
### 1.1.1 MAIN BODY

| | |
|---|---|
| Scanning method: | Flat-bed with ADF |
| Book scan: | Horizontal: Max. 298 mm [11.7"]<br>Vertical: Max. 432 mm [17.0"] |
| ADF: | Document size:<br>Width: 69 ~ 298 mm [2.7" ~ 11.7"]<br>Length: 120 ~ 2,000 mm [4.7" ~ 78.5"]<br>All pages in a document must be the same width<br>Document weight: 41 ~ 128 g/m$^2$ [11 ~ 34 lb.]<br>ADF capacity:<br>150 sheets (64 g/m$^2$ [20 lb.])<br>110 sheets (105 g/m$^2$ [24 lb.]/A4, A5, LT, HLT)<br>80 sheets (105 g/m$^2$ [24 lb.]/A3, DLT)<br>Stack height must be less than 15 mm [0.6"] |
| Scanning resolution: | Simplex mode:<br>Main scan: 100 ~ 800 dpi (in 1 dpi steps)<br>Sub scan: 100 ~ 800 dpi (in 1 dpi steps)<br>Duplex mode:<br>Main scan: 100 ~ 600 dpi (in 100 dpi steps)<br>Sub scan: 100 ~ 600 dpi (in 100 dpi steps) |
| Grayscales: | 8 bits/pixel |
| Initialization time: | About 15 seconds |
| Scanning speed: | 0.65 s/200 dpi (A4, binary picture mode) |
| Scanning throughput: | Simplex mode: 55 ppm/200 dpi (A4, binary picture mode)<br>Duplex mode: 86 ipm/200 dpi (A4, binary picture mode)<br>(Counted from the second page) |
| Interface: | SCSI-2 |
| Power: | 1) 102 to 138 V ac (45 to 65 Hz)<br>2) 187 to 276 V ac (45 to 65 Hz) |
| Power consumption (without all possible options): | Simplex model Standby: 50 W Max.<br>Scanning: 90 W Max.<br>Low power mode: 12 W Max.<br>Duplex model Standby: 80 W Max.<br>Scanning: 120 W Max.<br>Low power mode: 12 W Max. |

| | |
|---|---|
| Operating environment: | Temperature: 10 to 32°C [50 to 90°F]<br>Humidity: 20 to 80% RH |
| Weight: | Simplex Model: Less than 25 kg [55.1 lb.]<br>Duplex Model: Less than 26 kg [57.3 lb.]<br>(Add 1 kg [2.2 lb.] when the Endorser is installed.) |
| Dimensions (W x D x H): | 470 x 677 x 278 mm [18.5" x 26.7" x 10.9"] |

## 1.1.2 ENDORSER

| | |
|---|---|
| Number of printable characters: | 19 characters (max) |
| Character set: | 43 characters<br>0123456789#./-:,'AB ····Z |
| Character size: | 1.6 (W) x 2.8 (H) mm |
| Character pitch: | 2.4 mm ± 20% |
| Printable lines: | 1 line (main scan direction) |
| Inking: | Ink roll type |
| Ink refill: | Ink roll exchange |
| Ink color: | Purple |
| Print position: | a: 7 ± 4 mm<br>b: 0 ± 5 mm |

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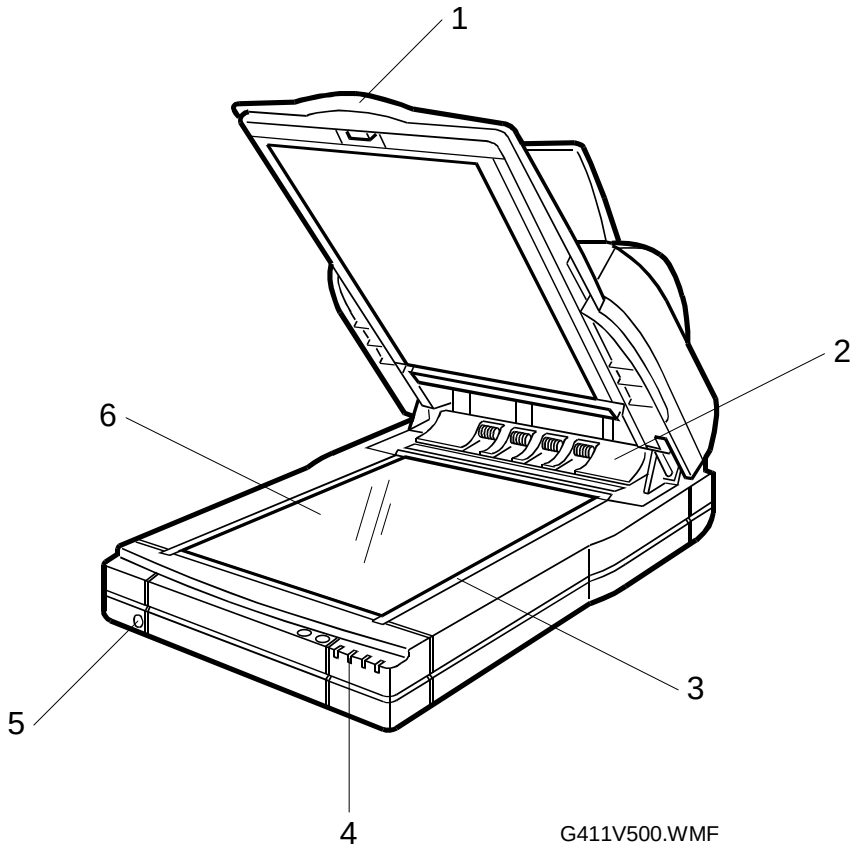
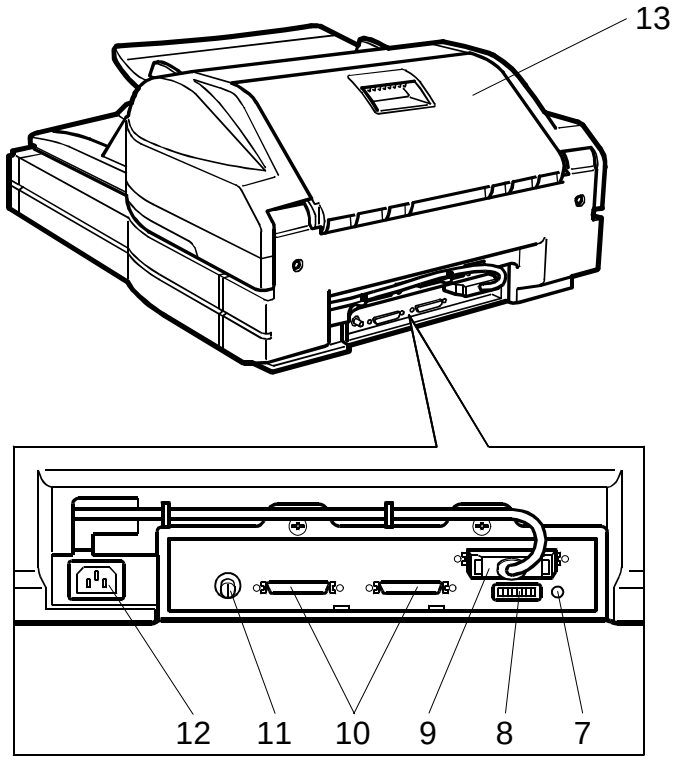
# 1.2 COMPONENT LAYOUT

## 1.2.1 FRONT VIEW




| No. | Name | Function |
|---|---|---|
| 1 | Platen cover | Covers the document and serves as a neutral background for documents placed on the main exposure glass. |
| 2 | ADF exposure cover | Covers the scanner and closes the ADF exposure cover interlock switch. Also contains an exposure glass. |
| 3 | Scale | Used for positioning a document when placing it on the exposure glass. |
| 4 | Scanner indicator lamps | The green and red lights indicate the condition of the scanner. |
| 5 | Power switch | Turns the power on and off. |
| 6 | Main exposure glass | A document to be scanned in book mode is placed face down on this glass. |

## 1.2.2 REAR VIEW

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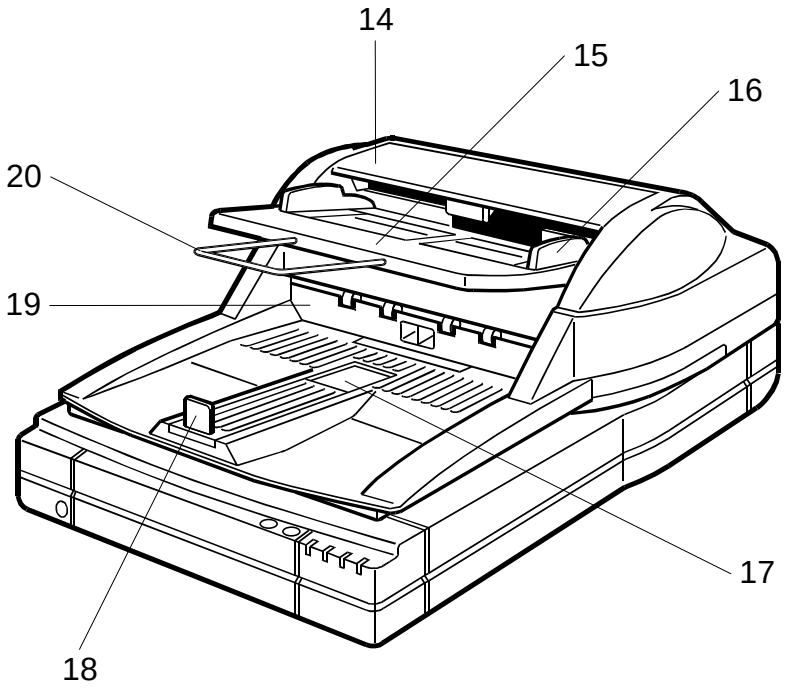
| No. | Name | Function |
|---|---|---|
| 7 | Reset switch | If this is pressed, the machine is reset. |
| 8 | DIP switches | Used to select various scanning modes and test modes. |
| 9 | Interface for reverse side scanning (Duplex model only) | Interface for the video signal during reverse side scanning. |
| 10 | SCSI connectors | For connecting the SCSI cables. |
| 11 | SCSI ID rotary switch | Used to select the SCSI ID and to select diagnostic tests. Note that positions 8 and 9 are interpreted as SCSI ID 7. |
| 12 | Power plug inlet | For connecting the power cord. |
| 13 | ADF cover | Open this cover to clear paper jammed at the input side. |

## 1.2.3 ADF

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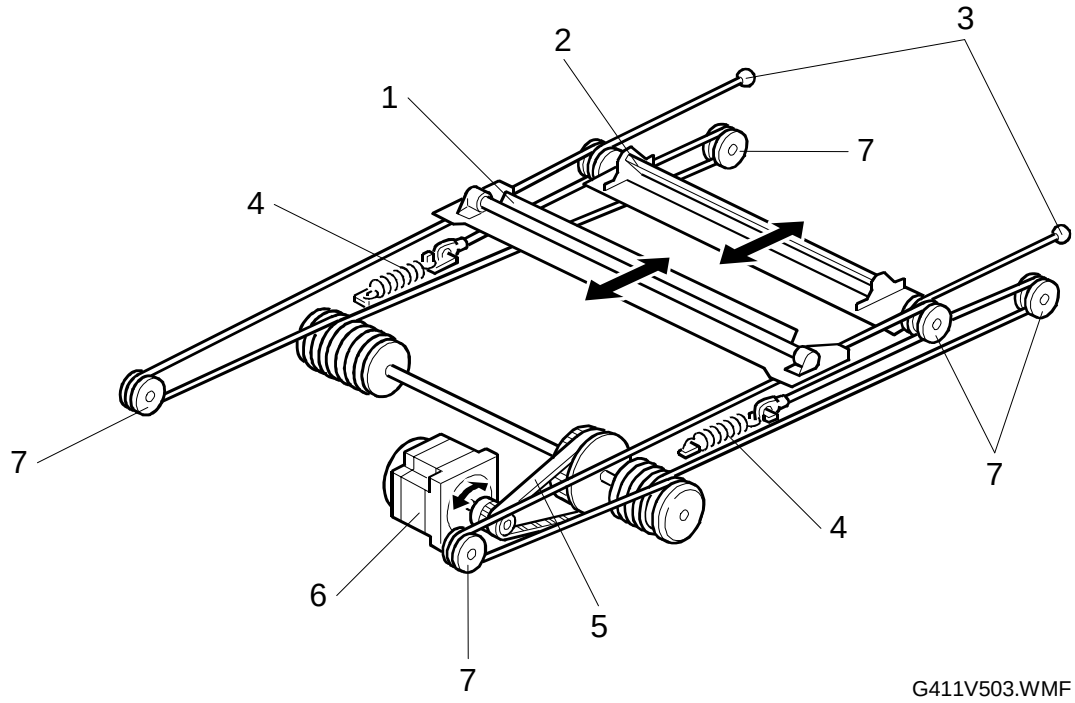
| No. | Name | Function |
|---|---|---|
| 14 | ADF | Automatically feeds multi-page documents into the scanner. |
| 15 | Document table | Documents to be scanned using the ADF are placed here. |
| 16 | Document guides | Used to properly align the documents placed in the input tray. |
| 17 | Exit table | Receives documents fed by the ADF after scanning. |
| 18 | Exit table extension | This holds the documents output from the ADF; it can be extended to support long documents. |
| 19 | Endorser cover | Open this cover to clean the endorser or replace the ink. |
| 20 | Document support wire | If long documents are placed in the input tray, this helps to feed them correctly. |

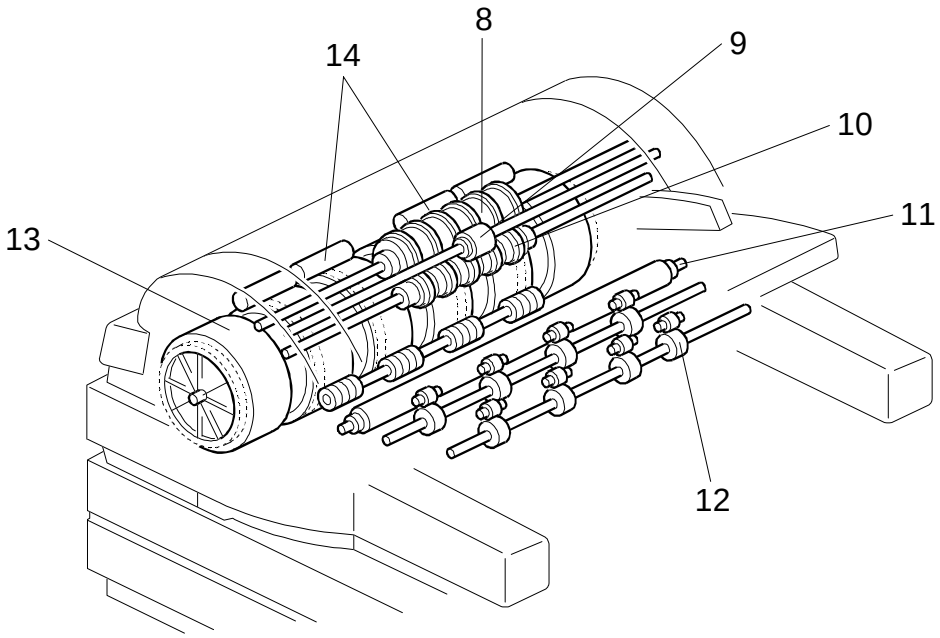
# 1.3 DRIVE LAYOUT

## 1.3.1 SCANNER




| No. | Name | Function |
|---|---|---|
| 1 | First scanner | Moves the exposure lamp along the document and sends the light reflected from the document to the 2nd scanner by means of a mirror. |
| 2 | Second scanner | Moves to keep the distance between the exposure lamp and the CCD constant, and sends light reflected from the 1st scanner to the CCD. |
| 3 | Scanner drive wires | Transmit motor power to the 1st and 2nd scanners. |
| 4 | Wire springs | Tighten the scanner drive wires. |
| 5 | Motor belt | Transmits motor power to the scanner drive wires. |
| 6 | Scanner motor | Drives the scanners. |
| 7 | Pulleys | Hold the scanner drive wires. |

## 1.3.2 ADF

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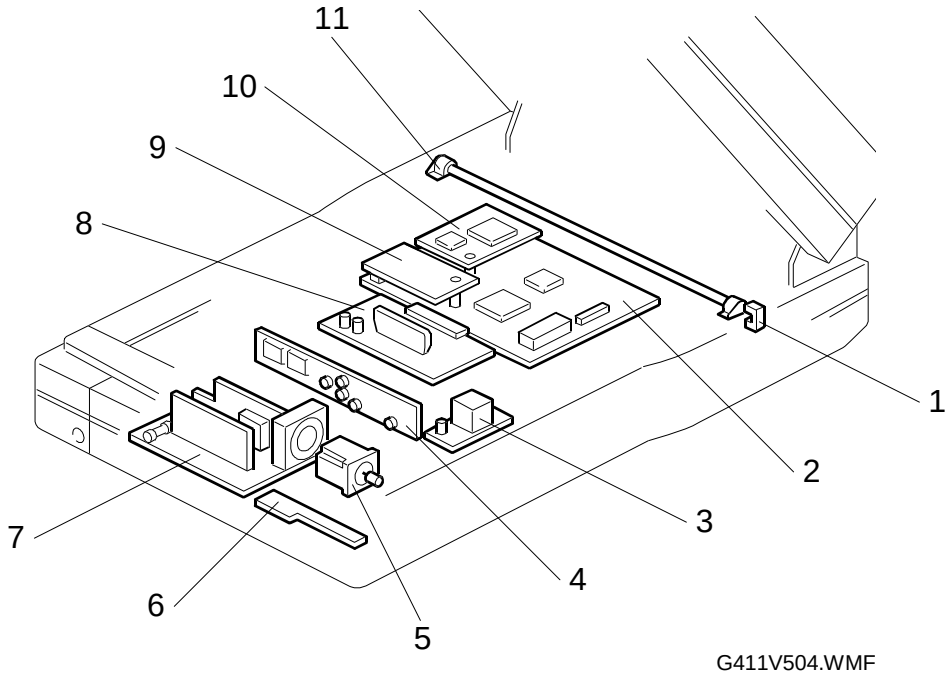
| No. | Name | Function |
|---|---|---|
| 8 | Feed roller | Feeds the top page of the original into the ADF. |
| 9 | Pick-up roller | Picks up and transports the top page of the original on the document table. |
| 10 | Separation roller | Stops the lower pages of the original while allowing the top one to pass. |
| 11 | White roller (Duplex model only) | Allows the machine to correct for variations in the white level of the CIS. |
| 12 | Feed-out rollers | Feed the scanned original onto the exit table. |
| 13 | Paper transport drum | Transports the original to the scanning position. |
| 14 | Paper transport rollers | Hold the original against the paper transport drum. |

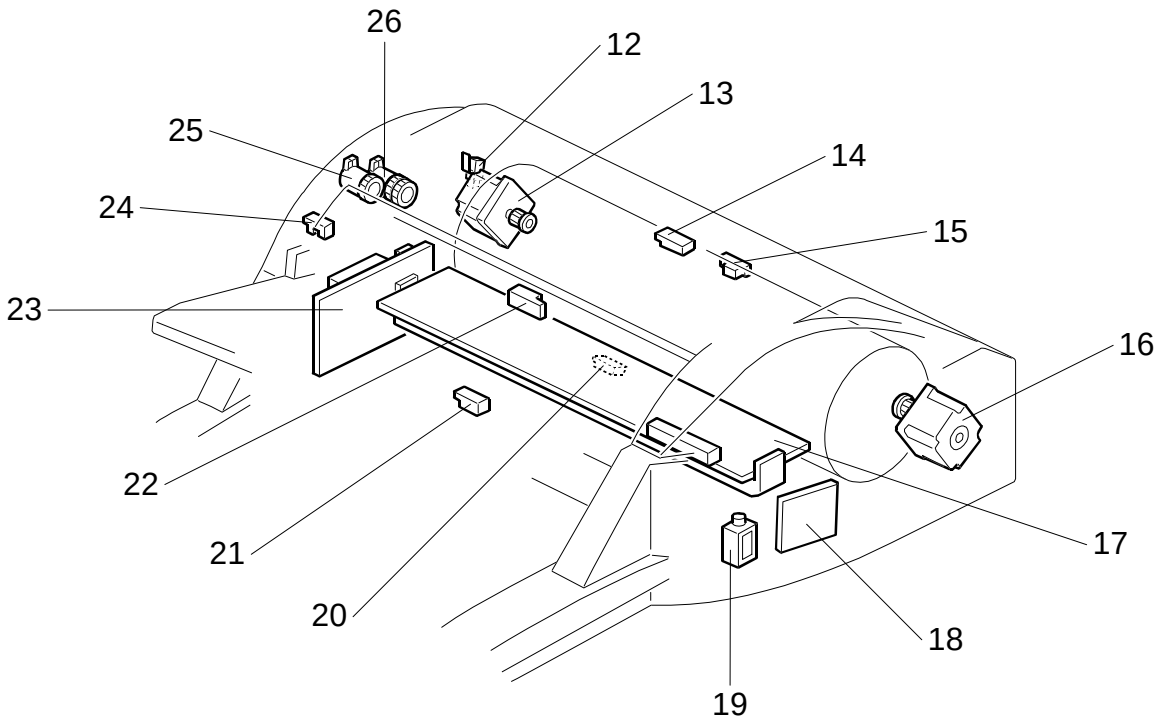
# 1.4 ELECTRICAL COMPONENT LAYOUT

## 1.4.1 SCANNER




| No. | Name | Function |
|---|---|---|
| 1 | Home position sensor | Detects whether the first scanner is at the home position. |
| 2 | SCU | Controls the overall scanner function. |
| 3 | Lamp Stabilizer | Provides ac power to the exposure lamp. |
| 4 | SBU | Contains the CCD, and outputs a video signal to the SCU. |
| 5 | Scanner Motor | Drives the scanners. |
| 6 | SOP | This contains the scanner indicator lamps. |
| 7 | PSU | Provides dc voltages to the system. |
| 8 | IOB | Controls the mechanical parts of the scanner. |
| 9 | IPU Board (Option) | Performs automatic text/image separation, dynamic threshold, section area, and document size detection. |
| 10 | RCU<br>(Duplex Model only) | Outputs a video signal of the reverse side of the original to the SCU. |
| 11 | Exposure lamp | Illuminates the original for exposure. |

## 1.4.2 ADF

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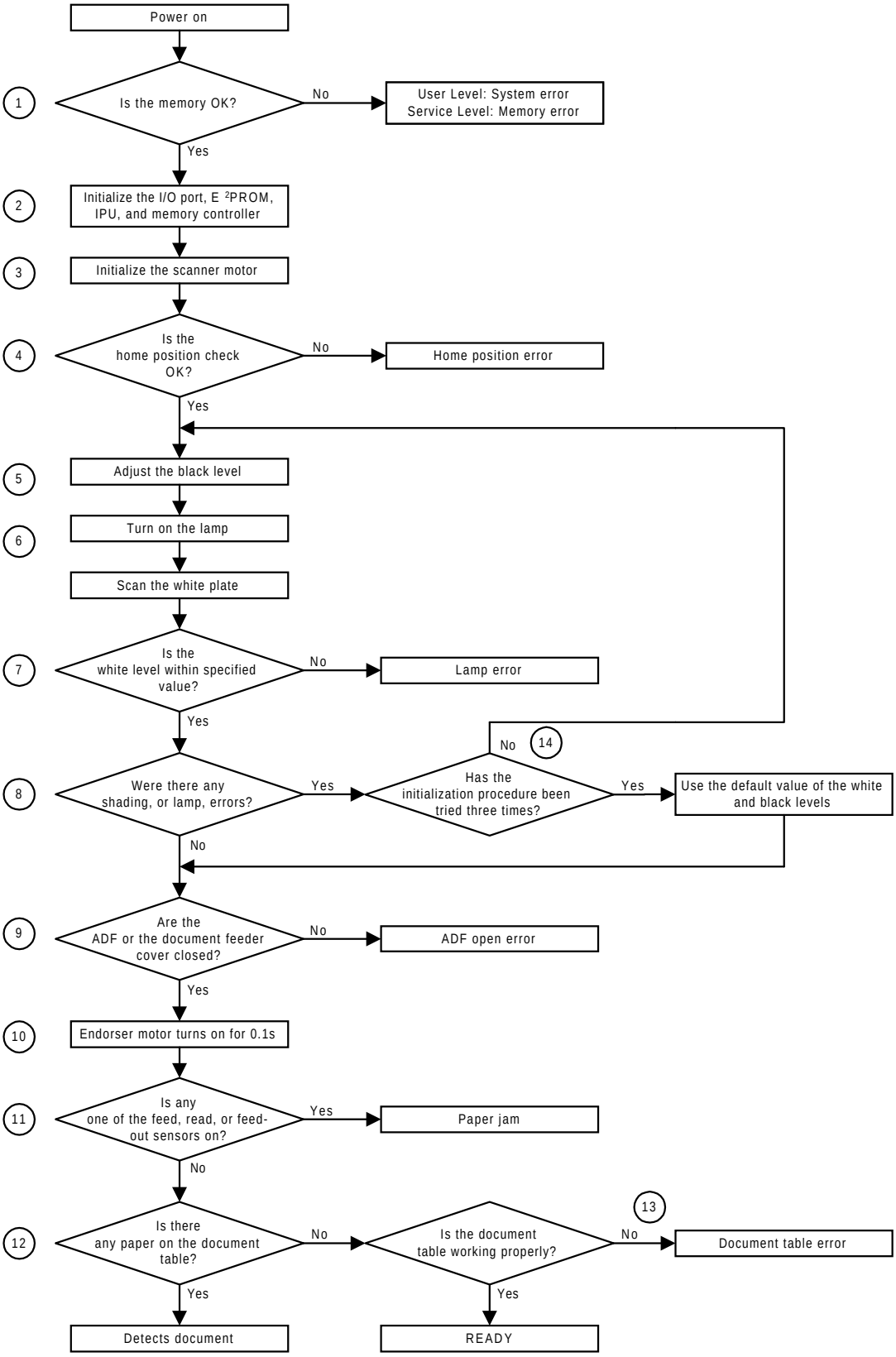
| No. | Name | Function |
|---|---|---|
| 12 | ADF interlock switch | Detects whether the ADF cover and platen cover are open or closed; cuts the power supply to the machine. |
| 13 | Paper transport motor | Drives the paper transport drum. |
| 14 | Feed sensor | Detects when a document is just before the feeding position. |
| 15 | Read sensor | Synchronizes the original exposure timing. |
| 16 | Paper feed motor | This drives the pick-up and feed rollers. |
| 17 | CIS (Duplex model only) | Contains the CCDs and LEDs that scan the reverse side of the original. |
| 18 | EDU (Option) | Controls the mechanical parts of the endorser. |
| 19 | Endorser solenoid (Option) | Moves the paper holding plate to hold the original at the endorser's printing position. |
| 20 | Relay sensor | Checks for original misfeeds. |
| 21 | Feed-out sensor | Detects when a document is at the feed-out position. |
| 22 | Document sensor | Detects when a document is placed on the document table. |
| 23 | ADU | Controls the mechanical parts of the ADF. |
| 24 | Document table position sensor | Detects if the document table is at the feed position or not. |
| 25 | Pick-up clutch | Controls pick-up roller rotation. |
| 26 | Document table lift clutch | Switches on to lift the document table up or down. |

# 2. DETAILED SECTION DESCRIPTIONS

## 2.1 INITIALIZATION






G411D503.WMF

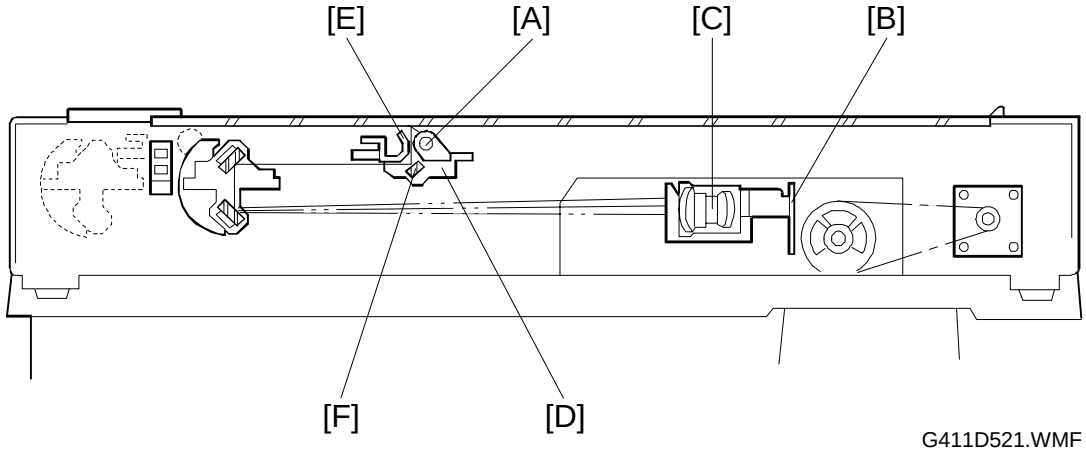
During power-up initialization, the scanner performs the following steps (refer to the flow chart on the previous page).

1. Tests the ROM checksum and makes a RAM read/write test. If the CPU cannot test these, the CPU determines that a memory error has occurred.
2. Initializes the I/O port, $E^2$PROM, and gate arrays (IPU and memory controller).
3. Initializes the scanner motor driver.
4. Checks the home position sensor signal timing while moving the scanners. If the CPU does not detect a signal change within the specified period, it determines that a home position error has occurred.
5. Adjusts the difference between the even and odd black levels and total black level.
6. Turns the exposure lamp on.
7. Adjusts the white level, and checks the peak level of the auto gain control. If the CPU cannot adjust them to the specified levels, the CPU determines that a lamp error has occurred.
8. If the black level or the white level cannot be adjusted properly during the above initialization process, the scanner retries the initialization up to three times. If the CPU detects an abnormal condition at the third time (step 14), the CPU stores the default values of the black and white levels into the NVRAM on the SCU.
9. Checks the ADF interlock switch signal. If the CPU detects that the switch is open, it determines that an ADF open error has occurred.
10. When the endorser unit has been installed, the endorser motor turns on for 0.1 second.
11. Checks the signals from the feed, read, and feed-out sensors. If any of them are on, the CPU determines that there is a paper jam.
12. Checks the document sensor signal. If the CPU detects a document on the document table, check #13 is not made until the document is removed.
13. Checks the document table position sensor signal timing while lifting and lowering the document table.
14. See step 8.

# 2.2 SCANNER MECHANISMS

## 2.2.1 BOOK MODE

### *Overview*

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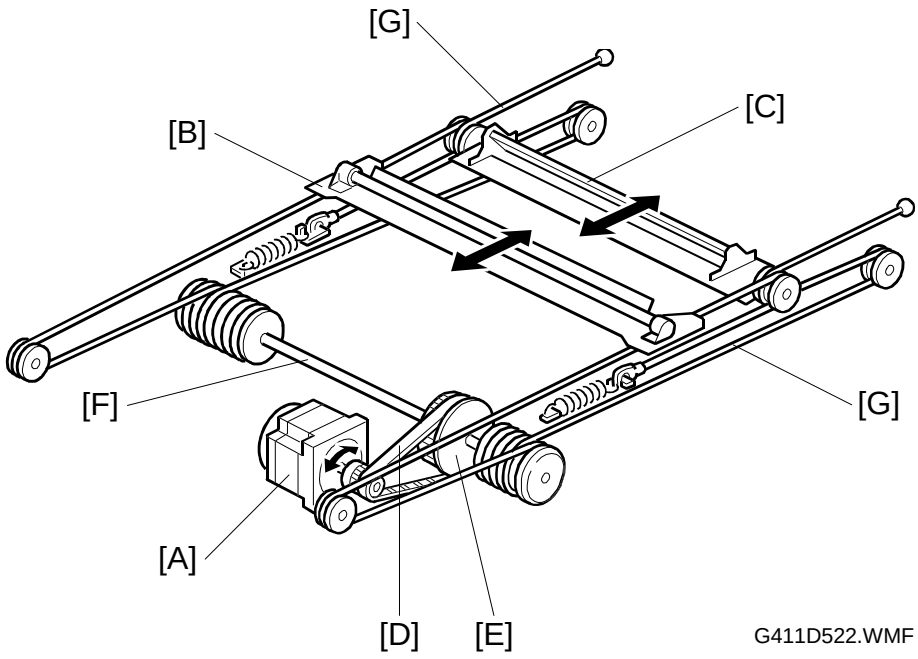
The exposure lamp (a xenon lamp in this model) [A] illuminates the original. The image is reflected onto a CCD (charge coupled device) [B] via the 1st, 2nd, and 3rd mirrors, and through the lens [C].

The 1st scanner [D] consists of the exposure lamp, a reflector [E], and the 1st mirror [F].

The exposure lamp is energized by an ac supply to avoid uneven light intensity while the 1st scanner moves in the sub scan direction (down the page). The entire exposure lamp surface is frosted to ensure even exposure in the main scan direction (across the page).

The light reflected by the reflector is of almost equal intensity in all directions, to reduce shadows on pasted originals.

### *Scanner Drive*

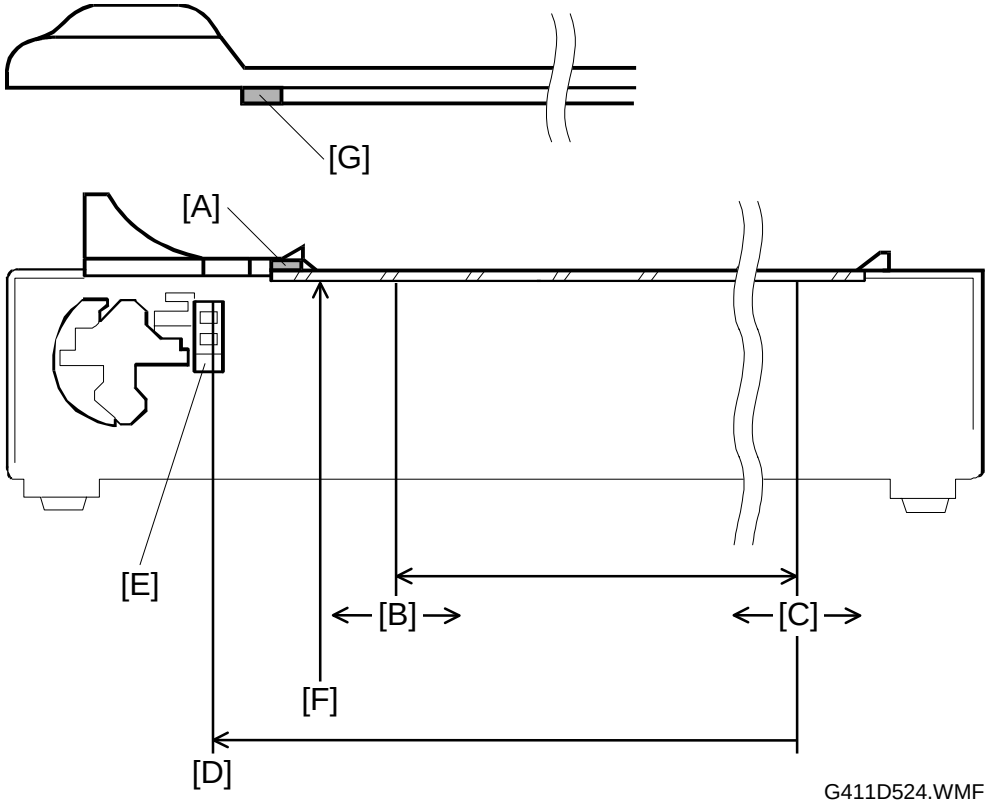



The scanner drive motor [A] (a stepper motor) drives the 1st and 2nd scanners [B, C] through the timing belt [D], scanner drive pulley [E], scanner drive shaft [F], and two scanner wires [G].

The IOB board drives the scanner drive motor. The scanning speed depends on the scanning resolution. The returning speed depends on the distance from the home position sensor.

### *Basic Scanning Procedure*

When the scan command is received from the host computer, the scanner starts scanning as explained in the following steps.




#### *Initialization*

The scanner checks the home position, scanner cover, and memory. If an error is detected, the scanner motor will stop.

The scanner scans the white plate [A] on the underside of the ADF exposure cover to perform the shading function.

#### *Image Scanning*

The scanner starts to scan the image area at the designated position [B]. The scanner stops after scanning the designated image area [C]. The arrows indicate that the scan start position and image area depend on the settings input by the user.

#### *Scanner Reversing*

After the image has been scanned, the scanners return to the home position [D].

The scanners are stopped when the first scanner activates the home position sensor [E]. If the scanner home position sensor is not activated within a certain time, a home position sensor error will occur.

## *Optional Steps (Optional IPU Board)*

### *Size Detection*

If selected, this is done after the ‘Initialization’ step.

**1) Main Scan Direction (Document Width)**
The first scanner moves to the book mode standard position ([F] on the previous page). Then, the scanner scans 5 mm from the book mode standard position.

The scanner determines the document width in the main scan direction from the output signal level. The edge of the document is detected by the difference between the level of the document data and the background signal which is provided by the silver plate [G] attached to the platen cover across the main scan.

If there is a gap at the leading edge, such as a tear (or a black stripe), extending more than 1 mm across the paper and more than 5 mm down the paper, the machine cannot detect the document width past this gap. In this case, an error message may appear, and scanning is impossible. . Disable this feature to allow the machine to scan this document.

**2) Sub Scan Direction (Document Length)**

The scanner detects the document size only in the main scan direction, and the scanner driver determines that the document length is the same as for a standard paper size of the same width.

**NOTE:** The scanner always assumes the paper is in a lengthwise orientation (i.e., the main scan is the short side). Also, in USA models, if Letter width is detected, the paper is always assumed to be Letter size (this means that the last few inches of a Legal-size original will not be scanned).

## *Read Size Command*

If selected, this is done after the ‘Initialization’ step.

**1) Read Size Command**
If the scanner receives the Read Size command in book mode, it detects the size in the main scan direction as described above.

The scanner sends the width data to the host computer.

After detecting the document size, the scanner scans the detected area.

### *Abort Command*

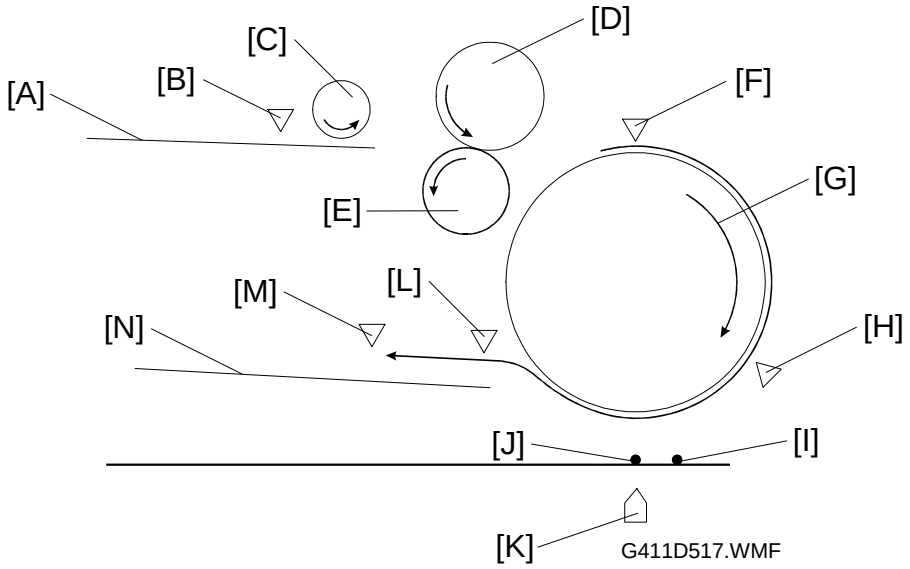
This can occur at any time during the basic scanning procedure.

If the Abort command is received during scanning, the scanner motor is stopped. Then the scanner returns to the home position ([D] in the previous diagram).

If this command is received while the scanner is reversing or checking the home position, the operation is not interrupted.

## 2.2.2 ADF MODE

***Overview***




When the originals are placed on the document table [A], the document sensor [B] detects them. The pick-up roller [C] picks up the originals and transports them to the feed roller [D]. The separation roller [E] turns in the opposite direction to the feed roller. As a result, just one original is sent to the paper transport drum [G]. The feed sensor [F] detects whether the original has reached the transport drum or not. Then the original turns with the transport drum through the read sensor [H]. While the original passes over the ADF scanning position [J], the scanner [K] reads the original. After reading, the original goes to the exit table [N]. The feed-out sensor [M] detects whether the original is fed out or not. The relay sensor [L] detects when an original is jammed in the area between the read sensor and the feed-out sensor. This sensor is monitored at all times except when the ADF is feeding a document.

### *Basic Scanning Procedure*

When the scanner receives the ADF scanning command, the scanner scans the original as described below.

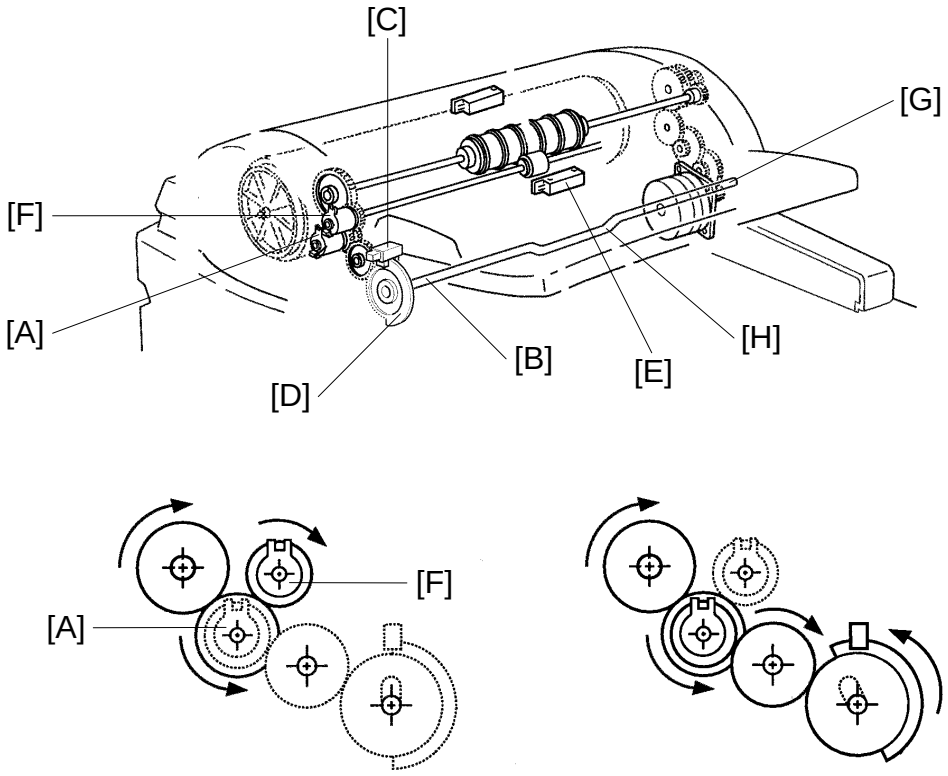
**1) ADF Mode**
The scanner performs the home position check and the shading process. If a home position error is detected, the scanner [K] will stop immediately. If an ADF cover open error or memory error is detected, the scanner will stop after returning to the home position.

The first carriage moves to the ADF scanning position [J] from the scanner home position [I]. Then the paper transport motor starts.

**2) SADF Mode**
The scanner waits until the designated time for the originals to be placed on the document table [A].

When the originals have been placed on the document table, the same procedure as for ADF mode is carried out.

### *Document Table Lift*




G411D518.PCX

The lift mechanism consists of the document table lift clutch [A], the lift shaft [B], the document table position sensor [C], and the sensor actuator on the gear [D].

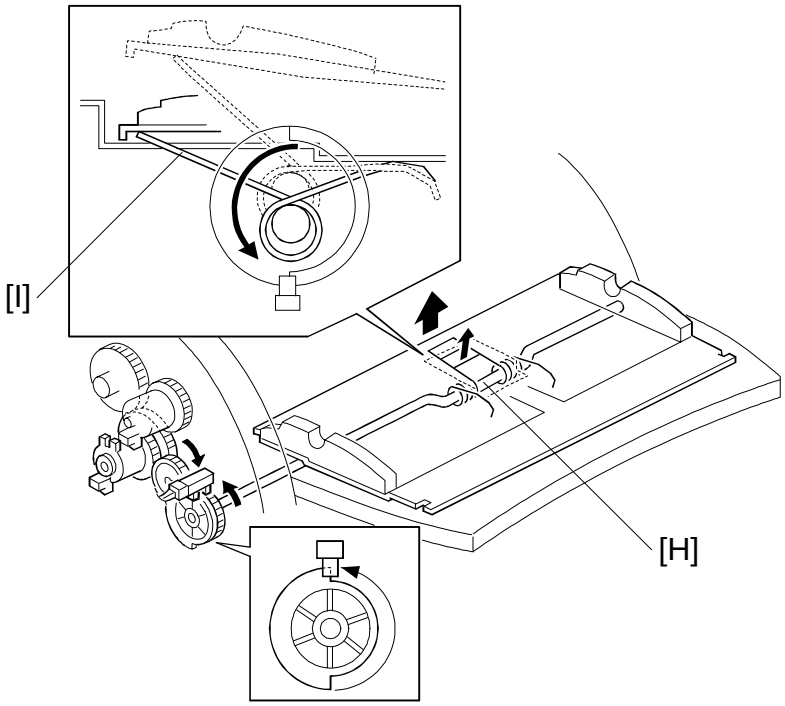
In standby mode, the bend in the lift shaft [H] is pointing downwards and the actuator is just inside the sensor.

When an original is placed on the document table, the document sensor [E] is activated. Then the paper feed motor [G] turns on. At the same time, the document table lift clutch [A] turns on to rotate the lift shaft.

At this time, the actuator starts to turn anticlockwise, and the flat part of the spring [I] that is loosely attached to the bend in the lift shaft pushes up the document table (see the next page for a diagram).

When the top of the document stack is pushed up against the pick-up roller, it can rise no more. However, the mechanism continues to push up against the tray until a half-turn of the shaft has been completed (i.e., until the actuator leaves the document table position sensor). At that time, the document table lift clutch and the paper feed motor turn off. If the actuator does not leave the sensor within a certain time, a document table error will occur.

The feed motor turns on again at a motor speed which depends on the scanning resolution, and the pick-up clutch [F] turns on to feed the top sheet of the original (see Original Feed and Separation).

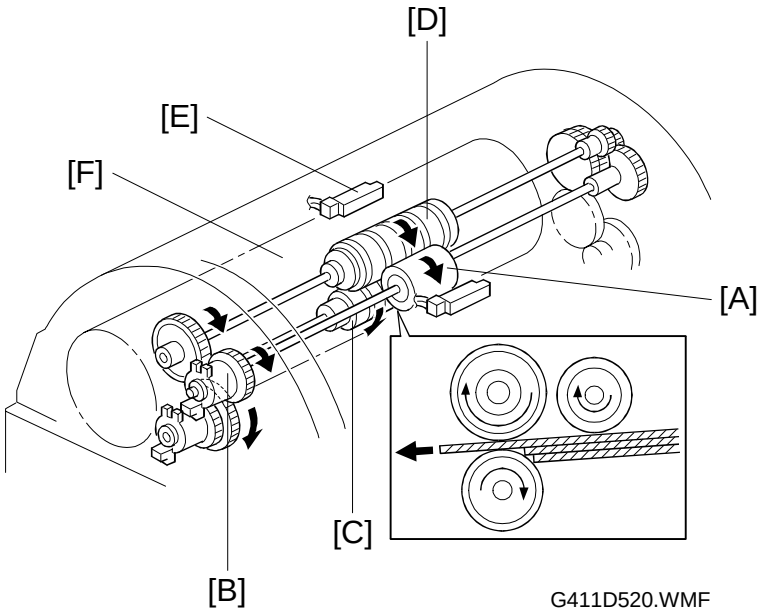



G411D519.WMF

When the first original is being fed, the bend in the lift shaft is pointing up, and the spring is at maximum compression. As sheets of the document are scanned, the spring pushes the document table upwards so that the top of the stack is always against the pick-up roller.

When all pages of the original have been fed out of the ADF, the document table lift clutch and paper feed motor are energized to lower the tray. They turn off when the document table sensor is deactivated. If the sensor is not deactivated within the designated time, a document table error will occur.

### *Original Feed and Separation*




To feed the original, the paper feed motor and the paper transport motor (which drives the paper transport drum) turn on. The paper feed motor drives the pick-up roller [A] through a train of gears and the pick-up clutch [B]. The pick-up clutch turns on to feed the top sheet of the original. If the pick-up roller feeds multiple pages of the original, the separation roller [C] and the feed roller [D] separate these pages (the separation mechanism is friction-based).

When the leading edge of the original activates the feed sensor [E], the paper feed motor and the pick-up clutch turn off, then the paper transport drum [F] feeds the original to the scanning position.

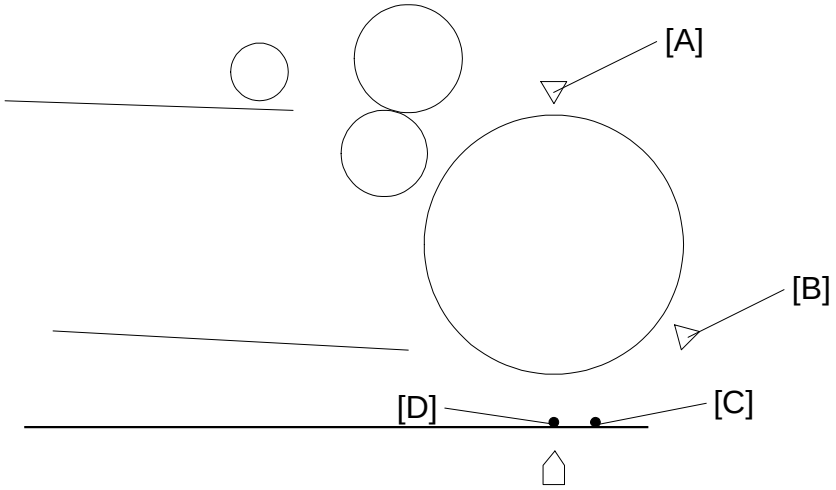
### *Image Scanning*

The scanner starts to scan the image when the leading edge has passed the read sensor by a certain distance (measured by motor pulses).

When the CPU has fed the trailing edge of the original 30 mm past the feed-out sensor, the transport motor turns off.

## *Optional Steps*

### *Size Detection*




If selected, this is done after document table lift/paper feed.

**1) Main Scan Direction (Document Width)**
This function will be available when the optional IPU board is installed.

First of all, the original is fed to the scan ready position between the read sensor [B] and the size detection position [C]. Then the first scanner moves to the size detection position [C] from the ADF scanning position [D]. After that, the original is fed to the ADF scanning position.

As a result of the above operation, the original is fed 5 mm past the first scanner. Then the CPU detects the original width. The edge of the document is detected by the difference between the level of the document data and the background level, which is provided by the black bracket located over the ADF exposure cover.

If there is a gap at the leading edge, such as a tear (or a black stripe), extending more than 1 mm across the paper and more than 5 mm down the paper, the machine cannot detect the document width past this gap. In this case, an error message may appear, and scanning is impossible. Disable this feature to allow the machine to scan this document.

After finishing the above operation, the first scanner returns to the ADF scanning position.

**2) Sub Scan Direction (Document Length)**
The length of the original is calculated by counting the motor pulses while the feed sensor [A] is on. (The length is detected during scanning.)

### *Read Size Command*

If selected, this is done after document table lift/paper feed.

If the scanner receives a Read Size command in ADF mode, it detects the document size in the main scan direction as described on the previous page.

The scanner sends the width data to the host computer.

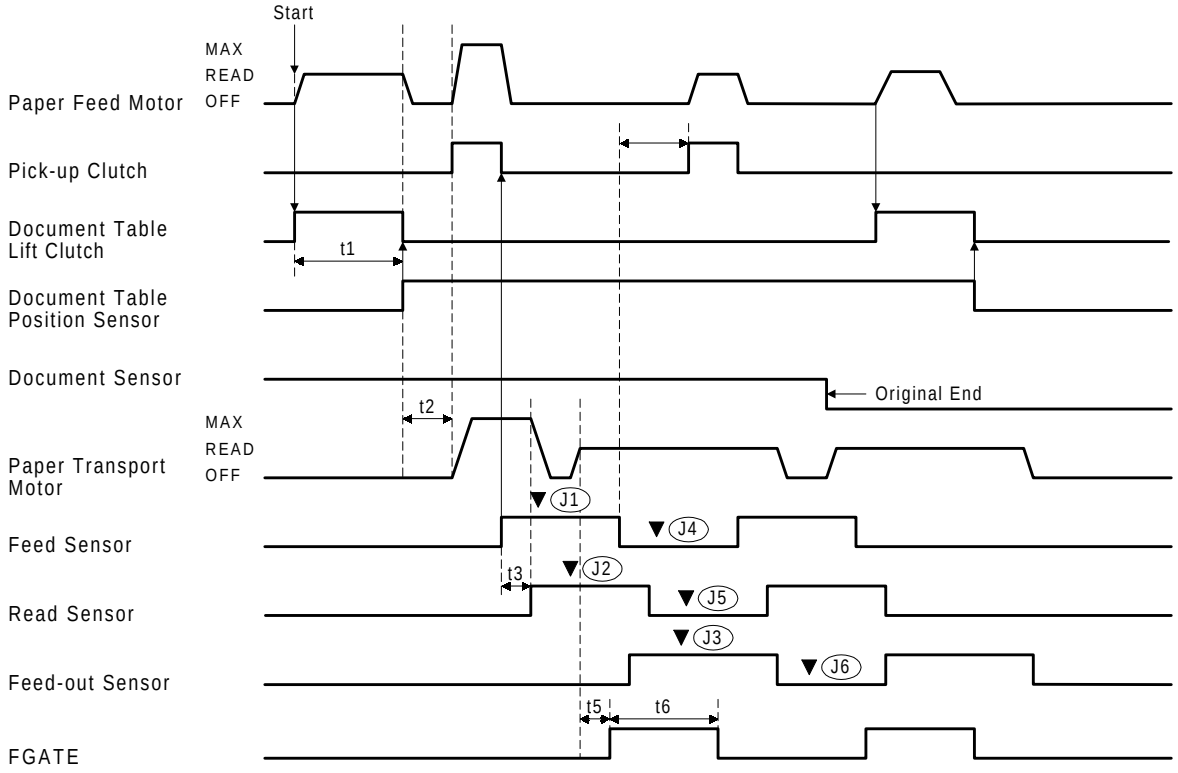


### *Abort and Unload Commands*

These can occur at any time during the basic scanning procedure.

When the CPU receives the Abort or the Unload command during paper transport, the scanner feeds out any original that is in the ADF.

# 2.3 PAPER MISFEED DETECTION




G411D527.WMF

FGATE: When this signal is high, scanned data is valid

Unit: milliseconds

| | t1 | t2 | t3 | t4 | t5 | t6 |
|---|---|---|---|---|---|---|
| 200 dpi | Within 3,000 | 210 | 205 | 44 | 24.64 | L x 0.011 x 200 |
| 400 dpi | Within 3,000 | 210 | 205 | 88 | 172.04 | L x 0.011 x 400 |

L: Document length (mm)

J1: The leading edge of the original does not reach the feed sensor within the time required for feeding the distance between the pick-up roller and the feed sensor + 150 mm after the pick-up clutch turned on.

J2: The leading edge of the original does not reach the read sensor within the time required for feeding the distance between the feed sensor and the read sensor + 150 mm after the feed sensor was activated.

J3: The leading edge of the original does not reach the feed-out sensor within the time required for feeding the distance between the read sensor and the feed out sensor + 30 mm after the read sensor was activated.

J4: The trailing edge of the original does not pass through the feed sensor within the time required for feeding the maximum original length (2 m) + 60 mm after the feed sensor was activated.

J5: The trailing edge of the original does not pass through the read sensor within the time required for feeding the original + 75 mm after the read was activated.

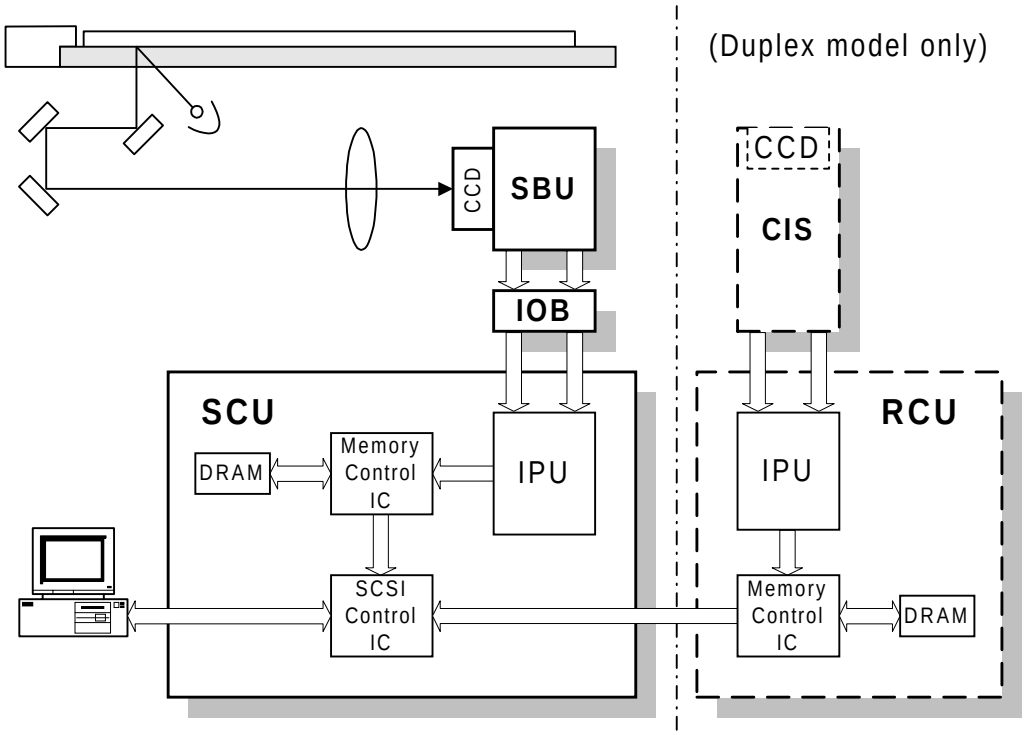
J6: The trailing edge of the original does not pass through the feed-out sensor within the time required for feeding the original length + 75 mm after the feed-out sensor was activated.

If an original jam or an original non-feed is detected, the paper transport motor, paper feed motor, and the exposure lamp turn off. Then, the appropriate LEDs inform the user of the machine's status.

If an original remains in the ADF, the original is fed out and the paper transport motor stops.

# 2.4 IMAGE PROCESSING

## 2.4.1 OVERVIEW

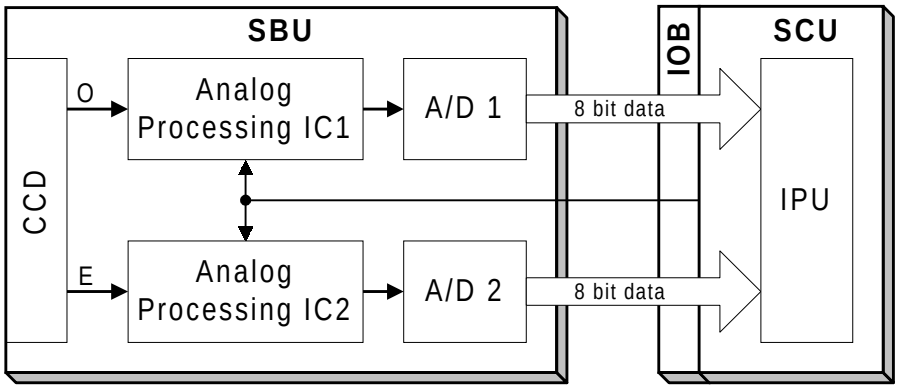



G411D508.WMF

The CCD generates two analog video signals. The SBU (Sensor Board Unit) converts these analog signals to 8-bit digital signals, then it sends these digital signals to the SCU (Scanner Control Unit) board through the IOB board. The IPU (Image Processing Unit) IC on the SCU does the image processing, then the image data goes to the computer through the Memory Control IC and the SCSI controller.

The CIS (Contact Image Sensor) unit in the duplex model for reverse-side scanning outputs two digital signals. The IPU on the RCU (Reverse Control Unit) board does the image processing, then the image data goes to the computer through the SCU.

## 2.4.2 SBU




G411D507.WMF

The CCD converts the light reflected from the document into an analog signal. The CCD line has 5,000 pixels and the resolution is 400 dpi (15.7 lines/mm).

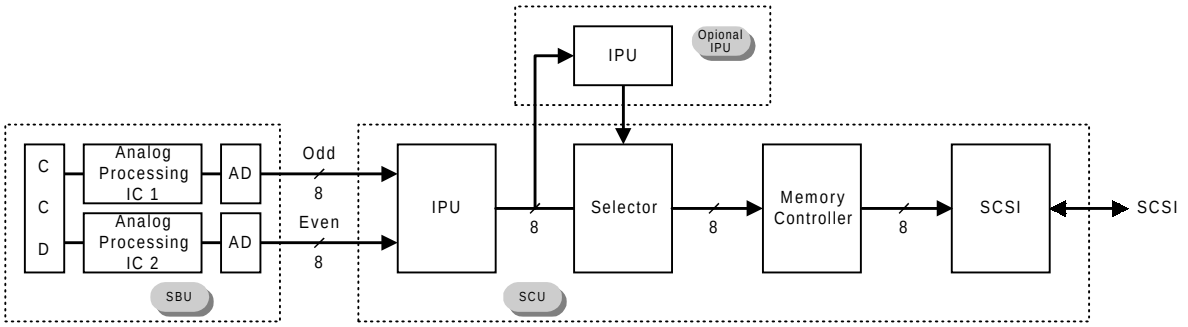
The CCD has two output lines, for odd and even pixels. Each of these has an analog processing IC. The analog processing IC performs the following operations on the signal from the CCD.

1. Z/C (Zero Clamp)
   Adjusts the black level reference for even pixels to mach the odd pixels.
2. Signal Amplification
   Operational amplifiers in the AGC (Auto Gain Control) circuit amplify the analog signal. The CPU on the SCU board controls the maximum gains of the operational amplifiers.

After the above processes, the analog signals are converted to 8-bit digital signals by the A/D converters. This gives a value for each pixel on a scale of 256 grades. Then these signals go to the SCU board.

## 2.4.3 IPU (IMAGE PROCESSING UNIT)

### *Overview*




G411D505.WMF

The image data from the SBU goes to the IPU IC on the SCU board, which carries out the following processes on the image data.

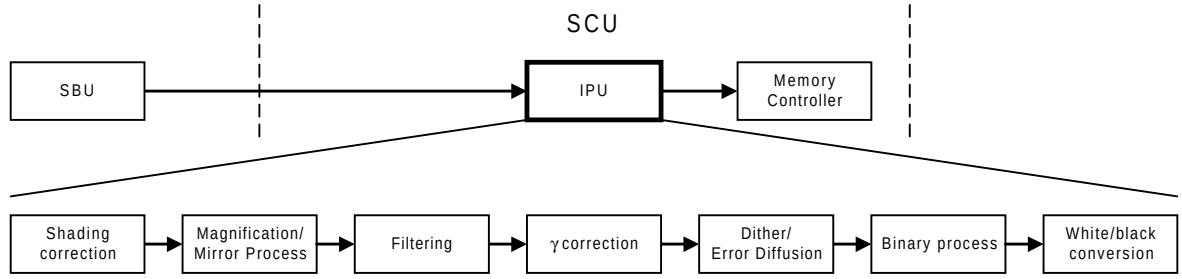
1. Auto shading
2. Magnification
3. Mirror processing
4. Filtering (MTF and smoothing)
5. $\gamma$ (gamma) correction
6. Grayscale processing
7. Binary picture processing
8. Error diffusion
9. Dithering
10. White/black conversion

The image data then goes to the memory controller IC.

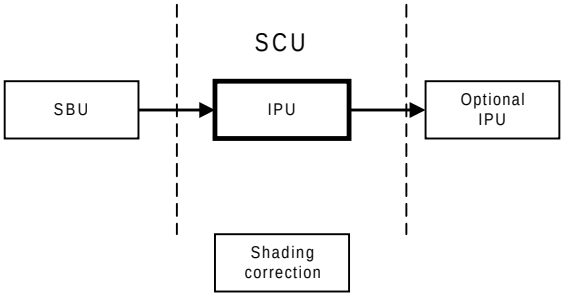
## *Image processing path*

The following image processing is for the scanner (simplex model), not including the optional IPU. The image processing for each of these units is explained in separate sections. However, when the optional IPU is installed, the IPU IC on the SCU only does the shading.

***1. Without Optional IPU***




***2. With Optional IPU***




G411D500.WMF

### *Shading Correction*

The machine scans the white plate opposite the ADF exposure glass to make a white waveform. Shading correction prevents uneven images caused by fluctuations in scanned data due to changes in light intensity and CCD sensitivity.

### *Magnification*

Reduction and enlargement in the sub scan direction are done by changing the scanner motor speed or paper transport motor speed in the ADF. However, reduction and enlargement in the main scan direction are done by the IPU.

### *Mirror Processing*

A mirror image of the original must be made for output.

### *Filtering*

There are two software filters: the MTF filter and the smoothing filter. The MTF filter emphasizes sharpness, and is used with text-only documents or documents that contain text and photo areas. The smoothing filter is used for photo-image documents.

***Gamma (γ) Correction***

The gamma curve corrects the response of the CCD to grayscales in the original.

***Grayscale Processing***

This process generates up to 256 image density levels for each pixel.

***Dithering***

Dither processing produces good quality grayscale images of photo originals.

***Error Diffusion***

The error diffusion process reduces the difference in contrast between light and dark areas of a halftone image. Each pixel is corrected using the difference between it and the surrounding pixels. The corrected pixels are then compared with a matrix table.

***Binary Picture Processing***

Each video signal level is converted from 8-bit to 1-bit (black and white image data) in accordance with a threshold value.

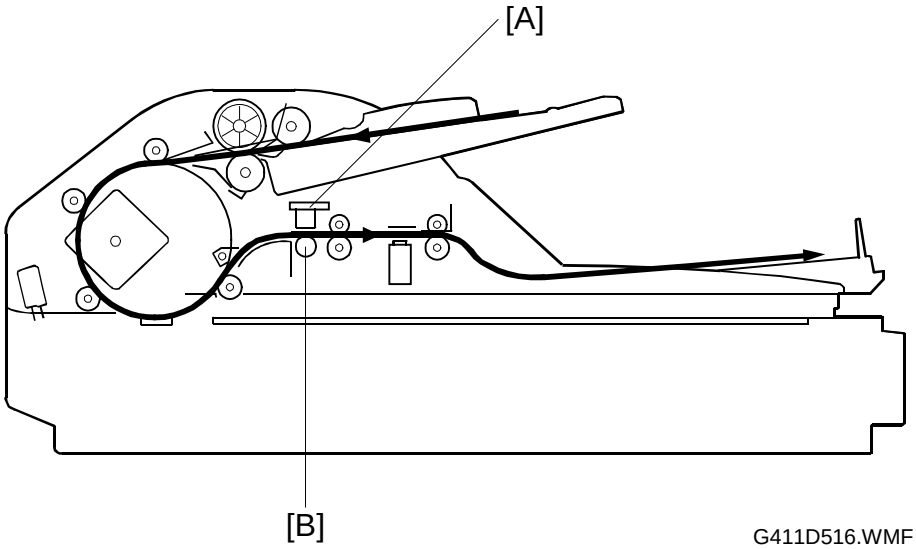
***White/Black Conversion***

Inverts the image (converts from white to black and vice versa).

After video processing, the data goes to the host computer through the memory and SCSI controllers.

# 2.5 REVERSE SIDE SCANNING

## 2.5.1 OVERVIEW

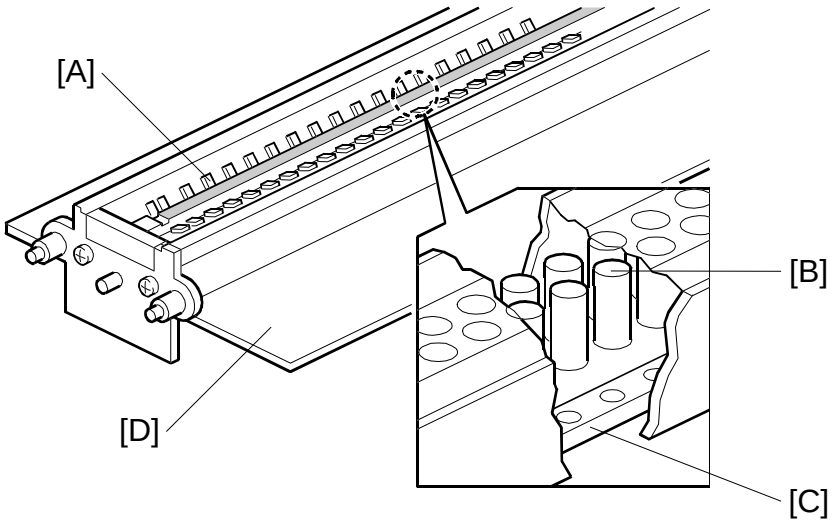



The CIS (Contact Image Sensor) unit [A], which is in the document exit area, scans the reverse side of the document.

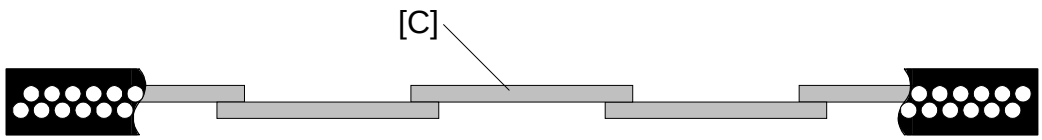
The front side of the document is scanned first. Then the document goes to the reverse side scanning area. The white roller [B] pushes the document against the CIS unit for scanning and feeds the document to the exit area.

The position of the CIS unit is fixed in the scanner, and cannot be adjusted in the field.

## 2.5.2 CIS (CONTACT IMAGE SENSOR) UNIT




G411D513.WMF




G411D528.WMF

The CIS unit consists of the LED array (68 chips/line x 2 lines) [A], rod lens array [B], five CCDs [C], and the CIS drive board [D] (this contains the CCD drive circuit, analog processing circuit, A/D converter, shading correction IC, and LED drive circuit). The CIS unit scans 4800 pixels in the main scan direction at a resolution of 400 dpi (15.7 lines/mm).

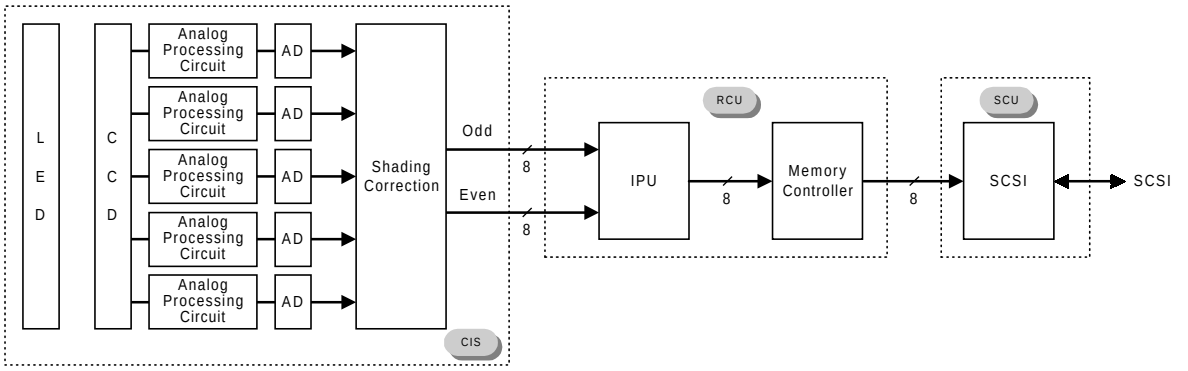
There is a row of LEDs on each side of the CCD so that the light is of almost equal intensity in all directions. This reduces shadows at the edges of documents.

The five CCDs are arranged as shown above (viewed from directly above the original feed path). The CCDs have dummy pixels at the ends, so to get a continuous scan across the page, the CCDs have to overlap. However, as a result, a continuous line cannot be scanned across the page at the same time. Data is held in memory and combined later.

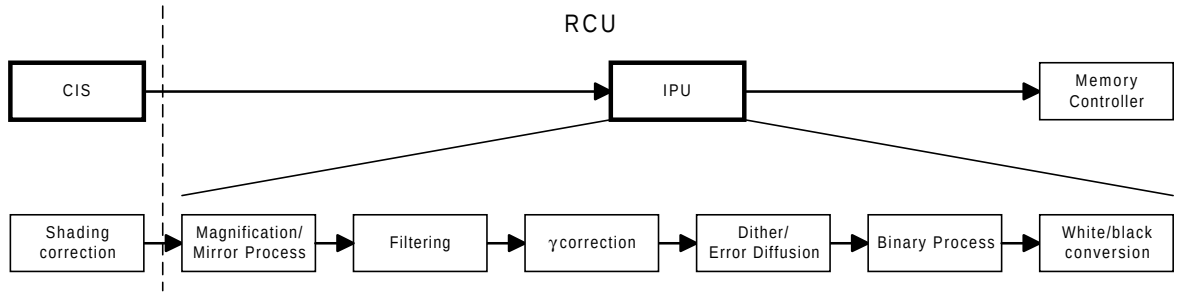
In book mode when scanning the front side, the scanner may stop if the buffer fills up. This may happen if the data is complex. Scanning may not start again in exactly the same place, due to mechanical inaccuracies. This is not a big problem when scanning the front side. However, for the reverse side, because a complete scan line is not scanned at the same time, it could mean loss of data.

Because of this, reverse side scanning is only enabled at 6 reproduction ratios (expressed in the driver as dpi: 100, 200, 300, 400, 500, and 600 dpi). This is because there is not enough memory to buffer the data and calculate the pixels for the resulting image at other resolutions without stopping the scanner.

## 2.5.3 IMAGE SCANNING




G411D504.WMF




G411D526.WMF

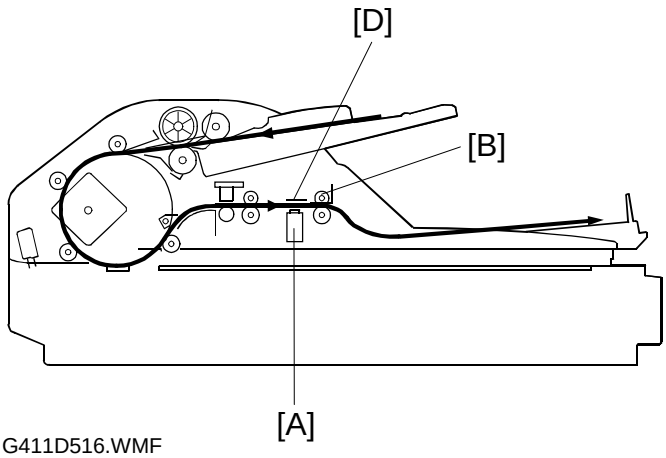
As explained on the previous page, the CIS unit contains five CCDs. The analog signal from each CCD goes to an analog processing IC. The function of the analog processing circuit is the same as for the SBU. After this, the analog signal is converted to a digital signal by the A/D converter. Then, the data goes to the shading circuit for correction. After shading, the data is divided to two signals: Odd and Even. Then, these go to the IPU on the RCU board.

The RCU board contains the IPU and memory controller ICs for image processing. The image processing in the IPU is the same as for the IPU in the SCU except for the shading correction.

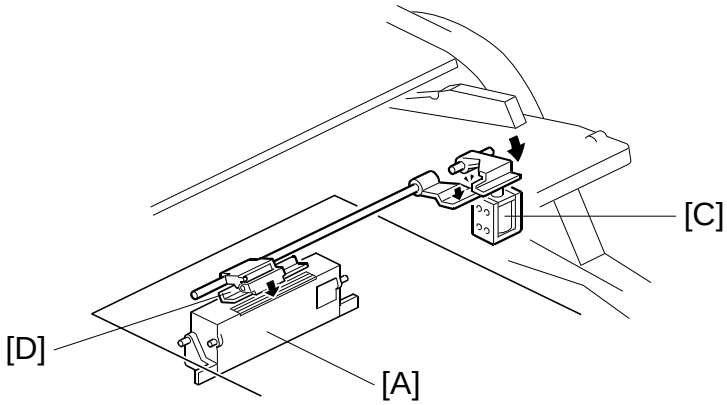
After image processing, the data goes to the PC through the SCSI controller on the SCU.

# 2.6 ENDORSER UNIT

## 2.6.1 OVERVIEW




G411D516.WMF



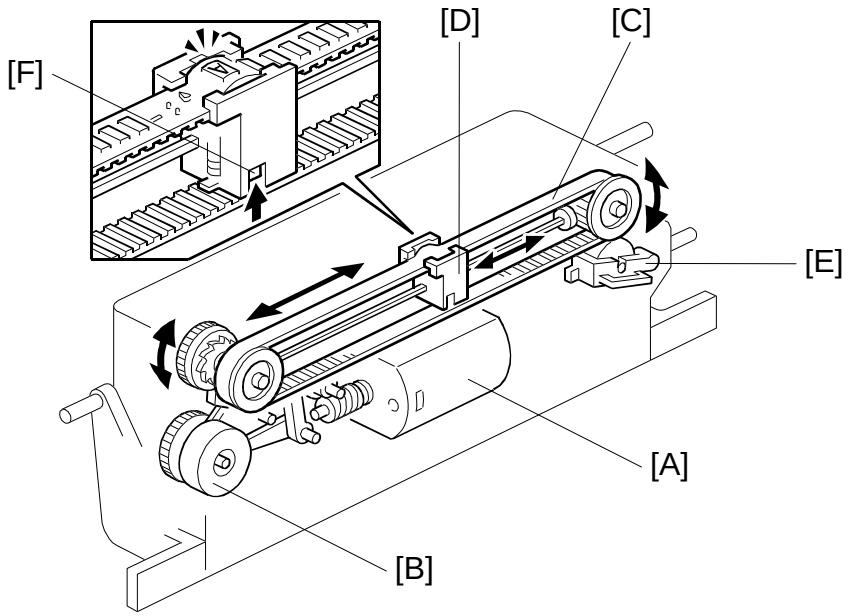

G411D514.WMF

The endorser unit [A] is located just before the exit roller [B]. The endorser unit prints up to 19 characters (which are input using the scanner driver) at the trailing edge of the document.

The endorser operates as follows.

1. The user inputs characters and enables the endorser function using the scanner driver.
2. The scanner operates in the normal ADF mode.
3. The paper transport motor stops at a certain time after the leading edge of the paper passes through the feed-out sensor.
4. The endorser motor turns on.
5. The endorser solenoid [C] is energized and the paper holding plate [D] goes down to hold the original.
6. The endorser prints the characters.
7. After printing, the endorser motor turns off.
8. The endorser solenoid is de-energized and the paper holding plate goes up to release the original.
9. The paper transport motor turns on again, and the original is fed to the original tray.

## 2.6.2 ENDORSER UNIT




G411D515.WMF

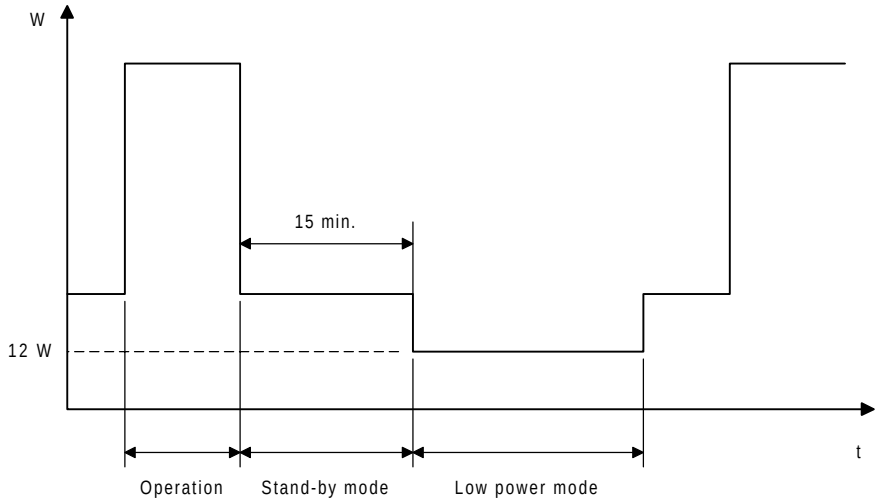
The endorser unit consists of the endorser motor [A], clutch [B], character belt [C], hammer unit [D], and ink roller [E].

The endorser motor drives the character belt and hammer unit and operates the hammer [F].

The clutch controls the print timing.

The ink roller always contacts the character belt and always supplies ink to the belt. When the ink is used up, the customer replaces only the ink roller.

# 2.7 LOW POWER MODE




G411D525.WMF

When the scanner has been idle for 15 minutes (this interval cannot be adjusted), the scanner automatically enters low power mode. However, the scanner cannot enter low power mode when a document jam or system error exists.

**NOTE:** The scanner can enter low power mode if the ADF cover and/or platen cover is open or paper remains on the document table.

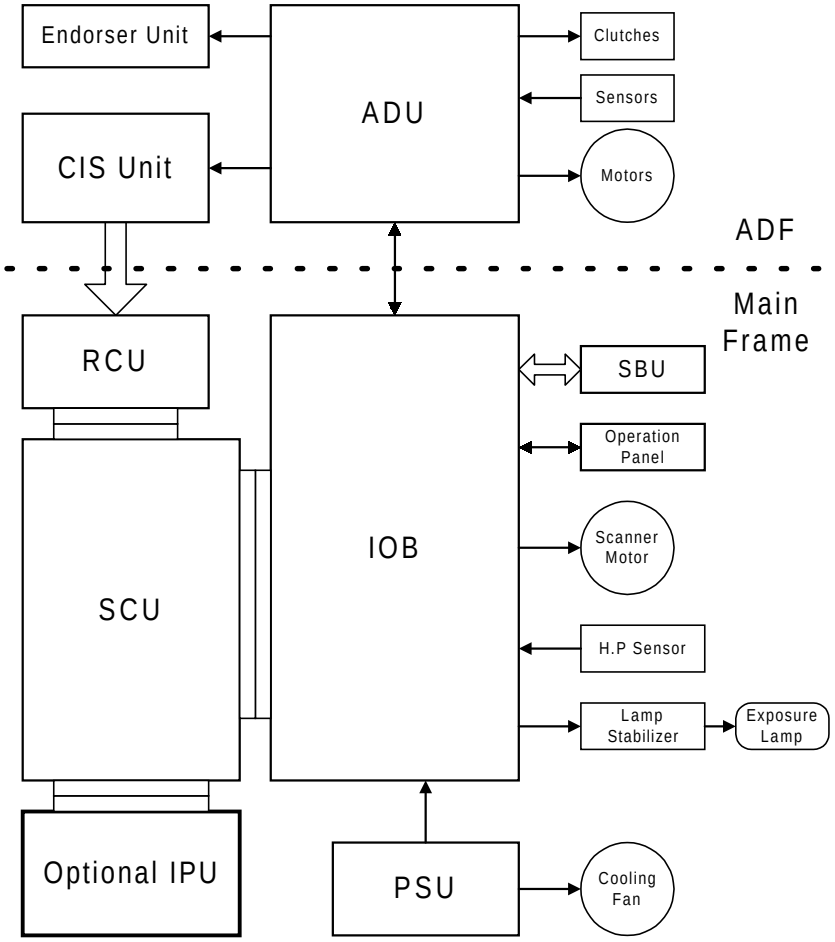
When the scanner enters low power mode, the PSU cuts the +24 V, +12 V, –12 V and +5 Vs supplies, and continues to supply +5VE only. As a result, the scanner consumes less than 12 W. The operation panel indicates that the machine is in low power mode with the following LEDs.

| LED | Status |
|---|---|
| Power on | Blinking |
| Machine busy | Off |
| Document in place | Off |
| Error | Off |

The scanner returns to stand-by mode when the ADF cover and/or platen cover is opened and closed, or when the user places a document on the document table, or when a Read command is received from the computer.

# 2.8 MAIN PCBs AND THEIR FUNCTIONS

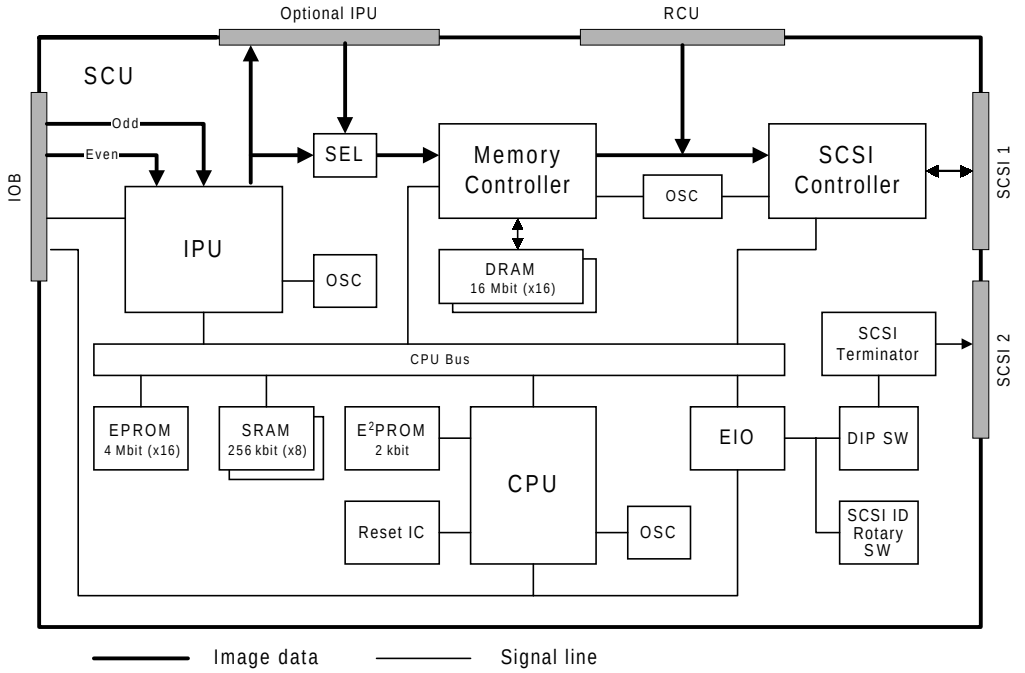
## 2.8.1 BOARD STRUCTURE




G411D509.WMF

For the main function of each PCB, refer to the Electrical Component Layout section.

## 2.8.2 SCU (SCANNER CONTROL UNIT)




G411D512.WMF

This is the main board. The functions of each component are as follows.

CPU: HD6413002F

- Scanner sequence control
- Clock/timer control
- DMA control

IPU (Image Processing Unit):

- Shading correction
- Image processing (Mirror image, reproduction ratios, MTF correction, binary picture processing, edge extraction, and so on)

Memory Controller:

- Stores the image data from the IPU in the memory (DRAM 32 Mbytes x 2).
- Address control when recalling the data from the memory.

SCSI controller: SCSI interface controller.

SRAM: Work area (32 kbytes)

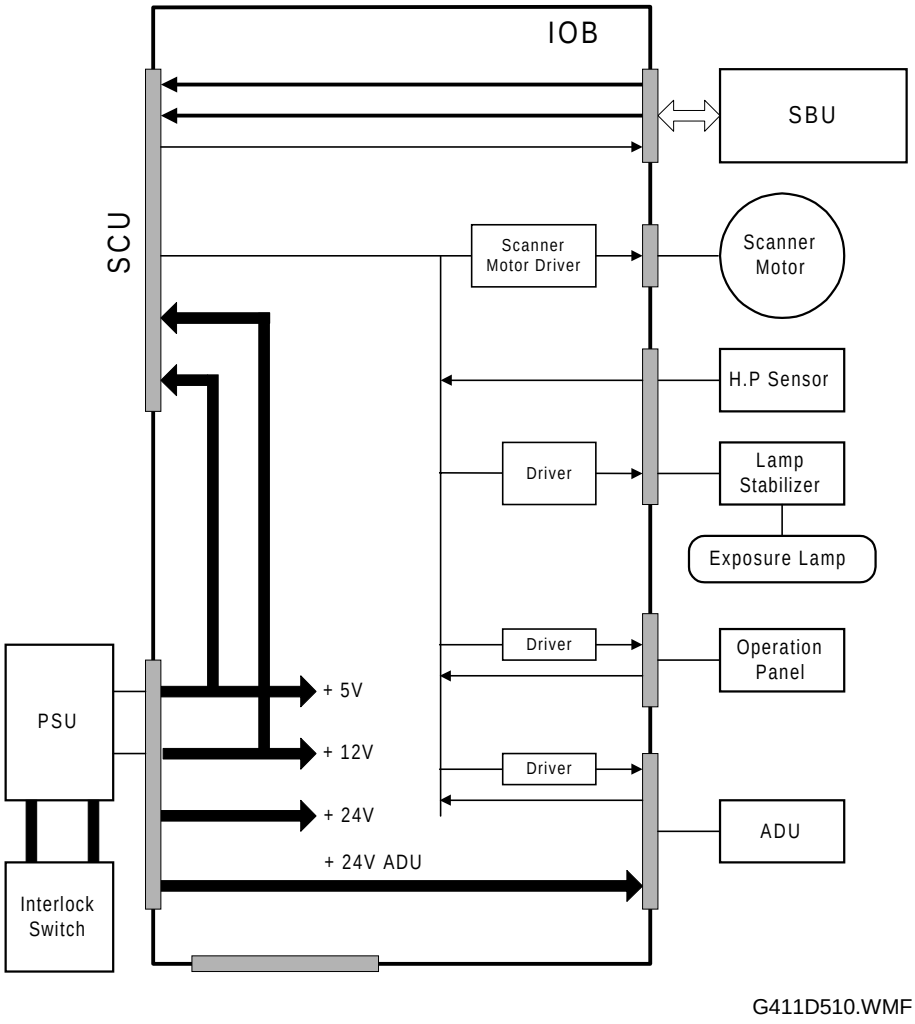
EPROM: Contains the program.

Enhanced I/O (EIO):

- Extension for the I/O port.
- DIP switches (mode selection), rotary switches (SCSI ID setting), and a push switch (reset button) are connected.

$E^2$PROM: Holds the book, ADF, and lamp counter values.

## 2.8.3 IOB (INPUT/OUTPUT BOARD)

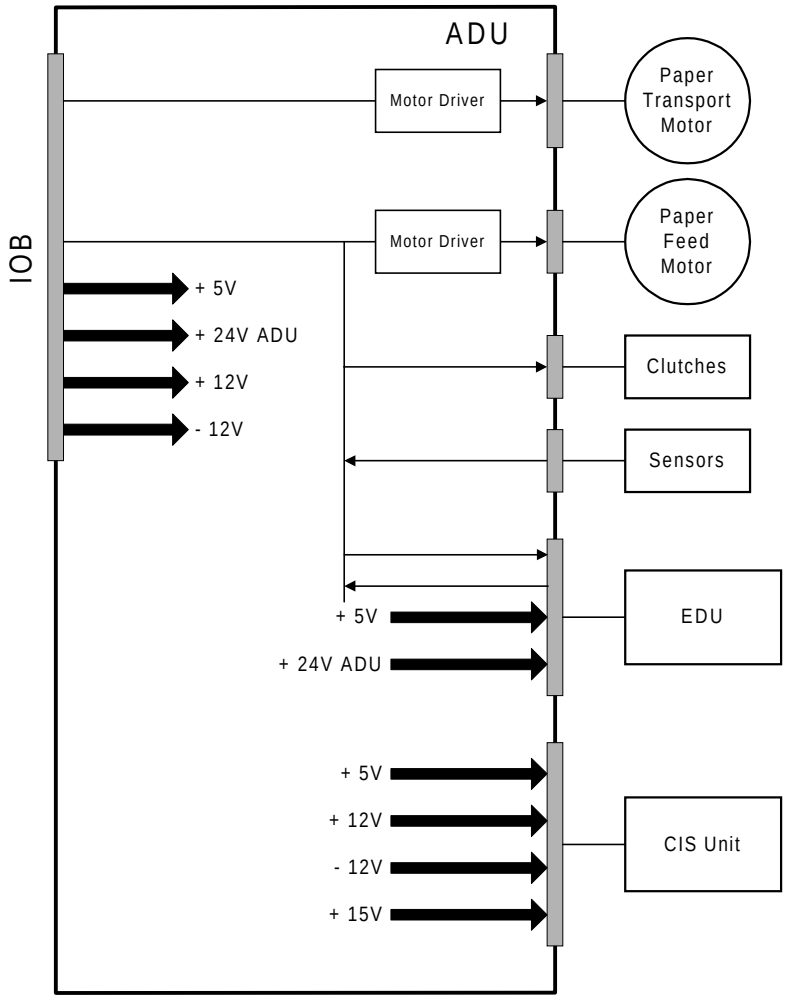



G411D510.WMF

The IOB contains the drive circuits for the scanner motor and the exposure lamp. The control signals such as drive and rotation direction, and drive current for the scanner motor come from the SCU. Also, the control signal for the exposure lamp comes from the SCU.

The image signals from the SBU go through this board to the SCU.

## 2.8.4 ADU (ADF DRIVE UNIT)




G411D511.WMF

The ADU drives the motors and clutches in the ADF unit. Also, it informs the sensor status to the SCU.

The SCU generates the control signals for each electrical component and the endorser, then these are sent to the ADU through the IOB. The drivers on the ADU convert the control signals into drive pulses for the motors.

# 3. INSTALLATION

## 3.1 ENVIRONMENT

### 3.1.1 PRECAUTIONS

Please observe the following precautions in order to ensure safe operation of the scanner and to realize its full performance.

- Ambient illumination must be less than 2,000 lux (do not expose to direct sunlight).
- Do not use the scanner in any location that is exposed to frequent vibration.
- Do not expose the scanner to dusty or corrosive atmospheric conditions.
- Ensure that the area in which the scanner is used is well ventilated (30 $m^3$/hr/person).
- Make sure that the surface on which you place the scanner is stable and level.



### 3.1.2 ENVIRONMENTAL CONDITIONS

Temperature: 10°C to 32°C (50 to 90°F)

Humidity: 20 to 80 %

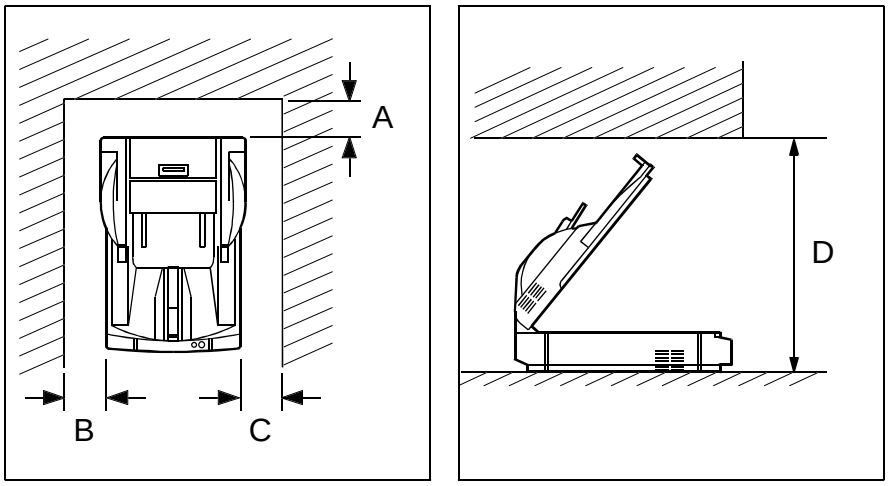
### 3.1.3 MACHINE LEVEL

1. Front to back: Within 5 mm (0.2") of level
2. Right to left: Within 5 mm (0.2") of level

### 3.1.4 MINIMUM SPACE REQUIREMENTS

Place the scanner near a power source, providing clearance as shown.

A: 10 mm (0.2") B: 30 mm (1.2") C: 600 mm (23.7")




G411I500.WMF

### 3.1.5 POWER REQUIREMENTS

**⚠CAUTION**

1. **Be sure to ground the scanner.**
2. **Make sure the plug is firmly inserted in the outlet.**
3. **Avoid multi-wiring.**

1. Input voltage level:
   - 102 to 138 V ac (45 to 65 Hz)
   - 187 to 276 V ac (45 to 65 Hz)
2. Permissible voltage fluctuation: ± 10%

## 3.2 SCANNER INSTALLATION

Please refer to the scanner user's manual for details.

## 3.3 IPU UNIT INSTALLATION

Please refer to the scanner user's manual for details.

# 3.4 ENDORSER UNIT INSTALLATION

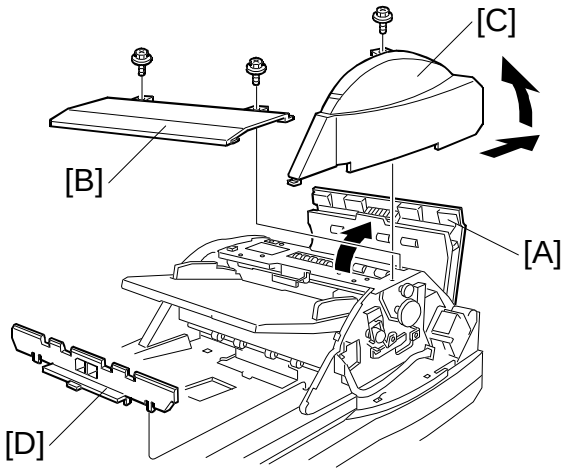
## 3.4.1 ACCESSORY CHECK

Check the quantity and condition of the accessories in the box against the following list:

| Description | Q'ty |
|---|---|
| 1. Endorser Unit | 1 |
| 2. Solenoid Ass'y | 1 |
| 3. EDU Board | 1 |
| 4. Harness | 1 |
| 5. Ink Roller | 1 |
| 6. Decal | 1 |
| 7. Screw - M3 x 6 | 2 |
| 8. Card Spacer | 1 |
| 9. Installation Procedure | 1 |

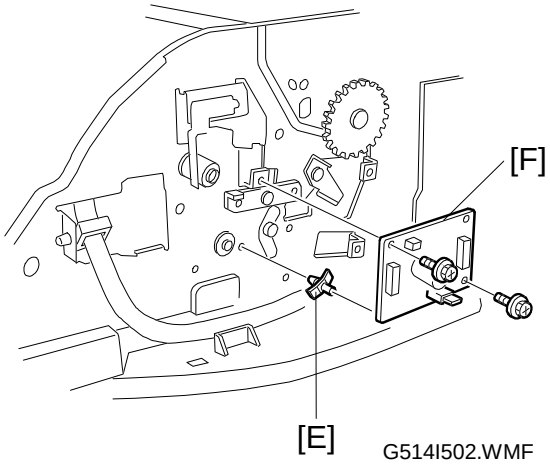
## 3.4.2 INSTALLATION PROCEDURE

1. Open the ADF cover [A]. Remove the ADF upper cover [B] (2 screws), ADF right cover [C] (1 screw), and the endorser cover [D].
   **NOTE:** Remove the right cover by carefully lifting it from the rear.



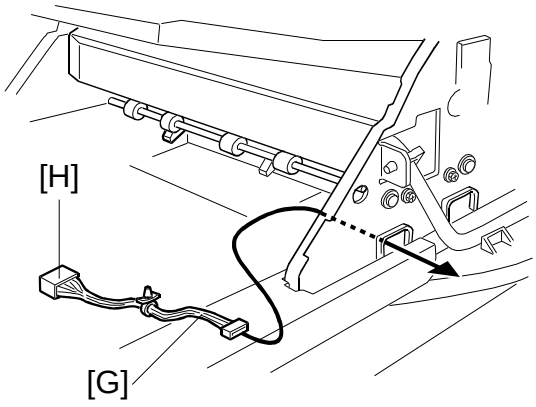

G514I501.WMF

2. Install the spacer [E] and the EDU board [F] (2 screws).



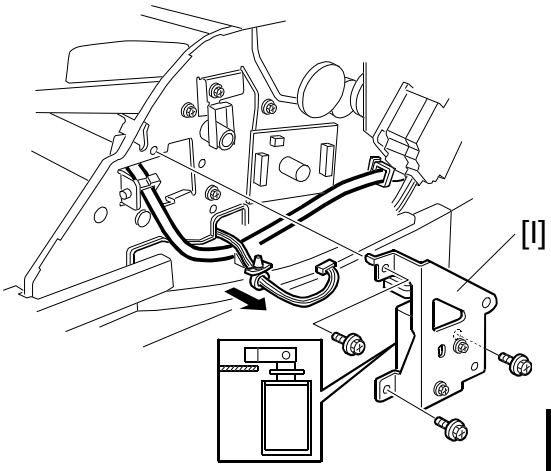

G514I502.WMF

3. Route the cable [G] as shown.
   **NOTE:** Ensure that the end of the cable with the large connector [H] is toward the inside of the machine.




G514I503.WMF

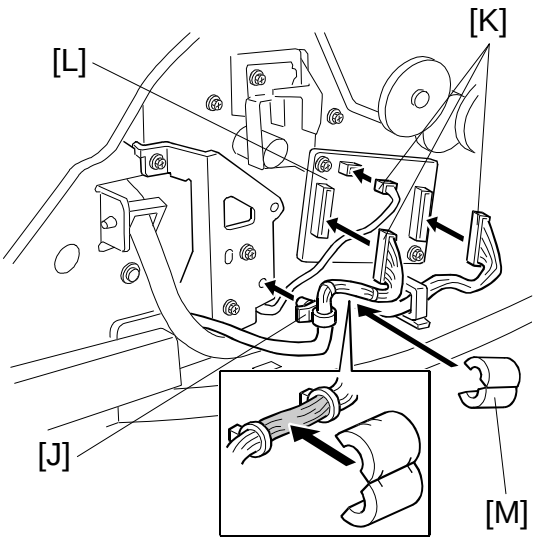
4. Install the solenoid assembly [I] as shown (3 screws).




G514I504.WMF

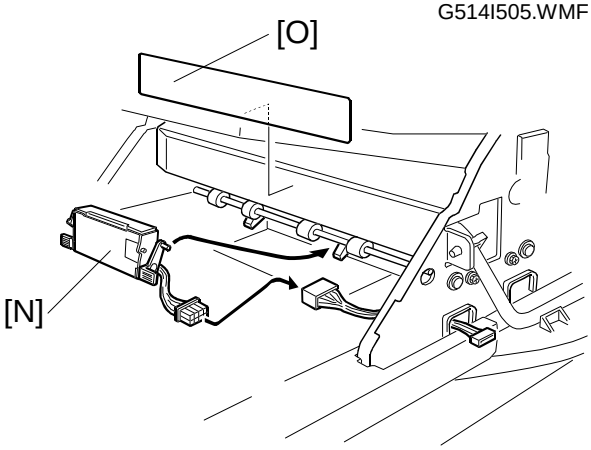


5. Install the clamp [J] and connect the three cables [K] to the EDU board [L].
6. Install the core [M].




G514I505.WMF

7. Open the platen cover. Install the endorser unit [N], as shown (1 connector).
8. Attach the decal [O].

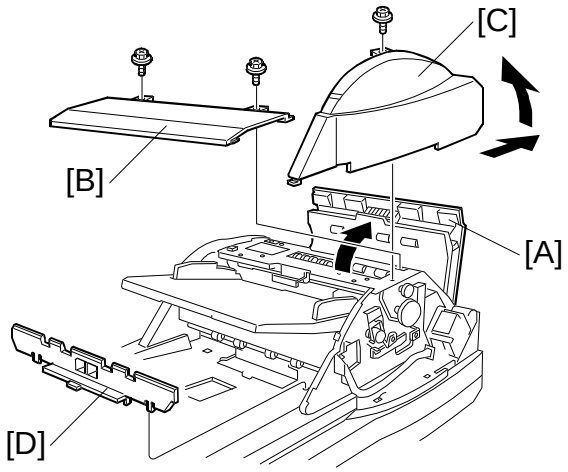



G514I506.WMF

9. Reinstall the endorser, right, and upper covers.

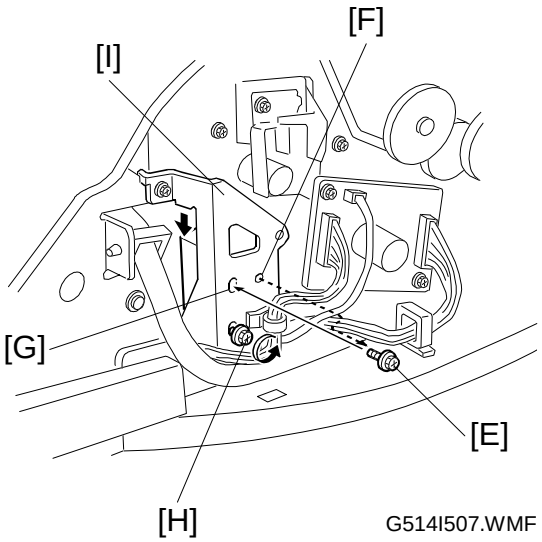
## 3.4.3 STAMP DENSITY ADJUSTMENT PROCEDURE

1. Open the ADF cover [A]. Remove the ADF upper cover [B] (2 screws), ADF right cover [C] (1 screw), and the endorser cover [D].
   **NOTE:** Remove the right cover by carefully lifting it from the rear.




G514I501.WMF

2. Remove the solenoid assembly screw [E] from the hole [F] and replace it in hole [G]. Do not tighten the screw yet.
3. Loosen the screw [H] and adjust the height of the bracket [I].
   **NOTE:** To reduce the stamp density, raise the bracket. To increase the density, lower the bracket.
4. Tighten the assembly screw [E] to secure the bracket in the new position.
5. Reinstall the endorser, right, and upper covers.




G514I507.WMF

# 3.5 RED LAMP UNIT INSTALLATION

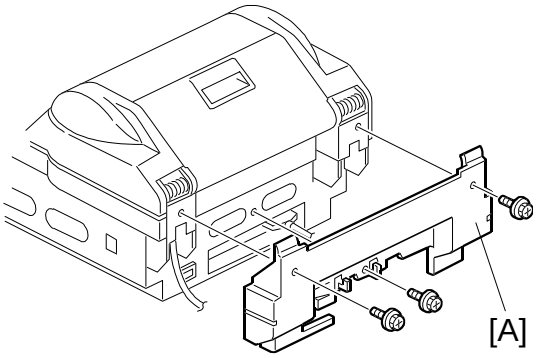
## 3.5.1 ACCESSORY CHECK

Check the quantity and condition of the accessories in the box against the following list:

| Description | Q'ty |
|---|---|
| 1. Exposure Lamp | 1 |
| 2. Installation Procedure | 1 |

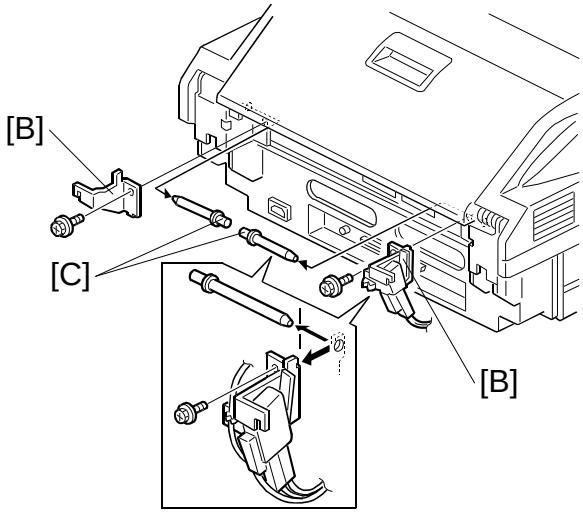
## 3.5.2 INSTALLATION PROCEDURE

1. Remove the rear cover [A] (3 screws).



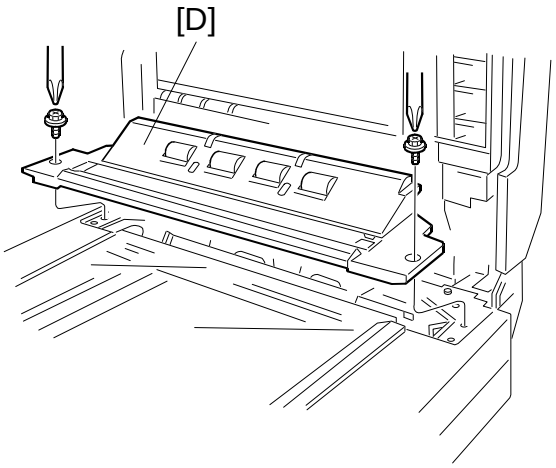

G514I500.WMF

2. Remove the stopper brackets [B].
3. Remove the pins [C].




G514I510.WMF

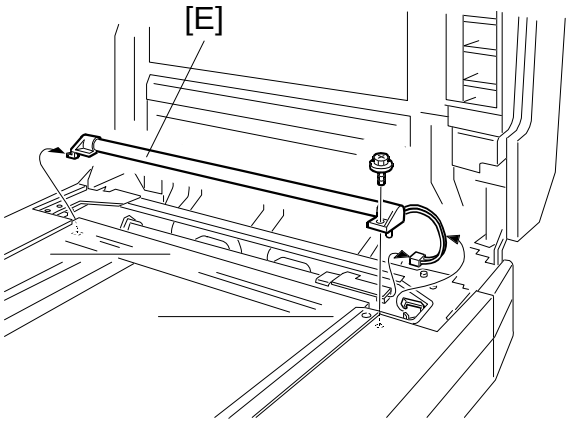
4. Open the platen cover and remove the lamp cover [D] (2 screws).




G514I508.WMF



5. Remove the exposure lamp [E] (1 screw).




G514I509.WMF

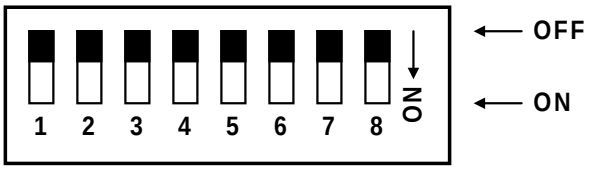
6. Install the red lamp (1 screw, 1 connector) in the place of the exposure lamp.
7. Reinstall the lamp cover, the pins, the stopper brackets, and the rear cover.

# 4. SERVICE LEVEL FUNCTIONS

## 4.1 DIP SWITCH SETTINGS

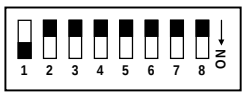
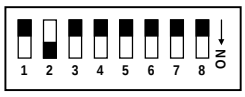
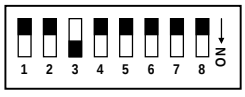
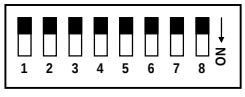
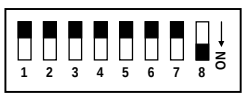
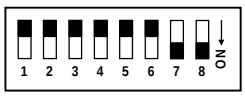
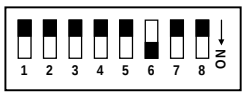
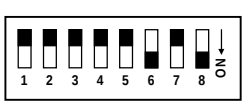
The factory default position of the dip switches is indicated in the diagram below.

After changing a dip switch setting, either switch the power off and then on again, or press the reset switch.

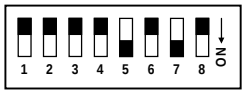
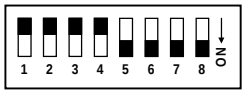



G411M500.WMF

### *Dip Switch Setting Table*

| Dip Switch | Item | Contents |
|---|---|---|
|  | SCAM function switch | OFF: SCAM function enabled<br>ON: SCAM function disabled |
|  | SCSI synchronous transfer switch | OFF: SCSI synchronous transfer enabled<br>ON: SCSI synchronous transfer disabled |
|  | Internal SCSI terminator switch | OFF: Internal SCSI terminator on<br>ON: Internal SCSI terminator off |
| Do not adjust switch 4. This is for factory use only. | | |
| **Service level test modes** | | |
|  | Various tests for the scanner are carried out using dip switches 5 to 8. Within each test mode, tests are selected by turning the SCSI ID rotary switch, and the machine's condition is indicated by the four LEDs on the covers.<br>Note the position of the SCSI ID rotary switch before you change it.<br>To return to normal operation mode after testing, switch dip switches 5 to 8 all off, return the SCSI ID rotary switch to its operating position, then press the reset button. | |
|  | Demonstration mode | Scanner demonstration in book and ADF modes; Refer to Table A later in this section. |
|  | Component test mode | Each component can be tested; refer to Table B later in this section. |
|  | Sensor test mode | Each sensor can be tested; refer to Table C later in this section. |
|  | Self diagnostic mode | Results of the diagnosis are indicated through a combination of the LEDs on the covers; refer to Table D later in this section and “Troubleshooting” in section 6. |

Service Tables

| Dip Switch | Item | Contents |
|---|---|---|
| | ADF counter indication | The number of pages scanned in ADF mode is indicated through a combination of the SCSI ID rotary switch position and the LEDs; refer to Table E later in this section.<br>(Unit = 1 sheet, Max. value = 2,500k sheets) |
| | Book mode counter indication | The number of pages scanned in book mode is indicated in the same way as described above for ADF mode; refer to Table E later in this section.<br>(Unit = 1 sheet, Max. value = 1,000k sheets) |
|  | Exposure lamp on time indication | The total illumination time of the lamp is indicated in the same way as above.<br>(Unit = 1 hour, Max. value = 3,000 hours) |
| | CIS on time indication | The total illumination time of the CIS is indicated in the same way as above. |
| | ADF counter indication (Reverse side) | The number of pages scanned in ADF mode is indicated in the same way as above.<br>(Unit = 1 sheet, Max. value = 2500 k sheets) |
| | Endorser character counter indication | The number of endorser characters is indicated in the same way as above. |
|  | Counter reset mode | After the dip switches are set to on, and the Start button is held down for more than 3 seconds, all LEDs are turned off, all counters which are stored in the $E^2$PROM are cleared.<br>(These counters are the ADF mode, book mode, exposure lamp, CIS and endorser character counters.) |

**NOTE:** If you change the position of the SCSI ID rotary switch during these tests, be sure to put it back to the original position after you have finished.

***Table A: Demonstration Mode***

| SCSI ID Rotary Switch No. | Contents |
|---|---|
| 0 | 200 dpi scan in book mode |
| 1 | 400 dpi scan in book mode |
| 2 | 200 dpi scan in ADF mode |
| 3 | 400 dpi scan in ADF mode |
| 4 | 200 dpi scan in endorser mode |
| 5 | 400 dpi scan in endorser mode |
| 6 | 200 dpi scan in duplex mode |
| 7 | 400 dpi scan in duplex mode |
| 8 | ADF free run *[1] |
| 9 | Not used |

*[1]: The scanner drives the ADF without any documents.

**NOTE:** During the demonstration, the LEDs indicate the machine status as usual. But if an error occurs during the demonstration (e.g. mis-feed, jam, etc.), the scanner stops, and the LEDs indicate the error condition.

***Table B: Component Test Mode***

| SCSI ID Rotary Switch No. | Contents |
|---|---|
| 0 | All components off |
| 1 | Exposure lamp on/off *[1] |
| 2 | Document table lift clutch on/off *[1] |
| 3 | Pick-up clutch on/off *[1] |
| 4 | CIS LEDs on/off *[1] |
| 5 | Endorser solenoid *[1] |
| 6 | Cooling fan motor on/off |
| 7 | Not used |
| 8 | Not used |
| 9 | Not used |

*[1]: When the Start button is pressed to start the test, the component turns on and off repeatedly.



***Table C: Sensor Test Mode***

| SCSI ID Rotary Switch No. | Contents |
|---|---|
| 0 | Home position sensor |
| 1 | Read sensor |
| 2 | Document table position sensor |
| 3 | Document sensor |
| 4 | ADF cover interlock switch |
| 5 | Feed sensor |
| 6 | Feed-out sensor |
| 7 | Relay sensor |
| 8 | Not used |
| 9 | Not used |

If the selected sensor is on, all LEDs turn on. If the selected sensor is off, all LEDs turn off.

### *Table D: Self Diagnostic Mode*

During the self-diagnostic mode, the scanner performs the following tests.

1) Home position error check
2) Exposure lamp error check
3) White level error check
4) Document table error check
5) SCU error check
6) RCU error check
7) IPU error check
8) CIS LEDs error check
9) Memory error check

If the scanner detects errors, the first error that occurred is indicated by a combination of four LEDs.

| Error Items | LEDs | | | |
|---|---|---|---|---|
| | Power On (Green) | Machine Busy (Green) | Document in Place (Green) | Error (Red) |
| SCU error | Blinking | — | — | Blinking |
| RCU error | Blinking | — | On | Blinking |
| IPU error | Blinking | On | — | Blinking |
| Home position error | Blinking | Blinking | Blinking | On |
| Exposure lamp error | Blinking | Blinking | On | On |
| White level error | Blinking | Blinking | — | — |
| CIS Leds error | Blinking | Blinking | On | Blinking |
| Memory error (Simplex) | Blinking | — | — | — |
| Memory error (Duplex) | — | Blinking | — | — |

On: LED on Blinking: LED blinking —: LED off

### *Table E: Counter Indication Mode*

#### *Rotary Switch Table*

| SCSI ID Rotary Switch No. | Contents |
|---|---|
| 0 | Not used |
| 1 | Units |
| 2 | Tens |
| 3 | Hundreds |
| 4 | Thousands |
| 5 | Ten thousands |
| 6 | Hundred thousands |
| 7 | Millions |
| 8 | Not used |
| 9 | Not used |

### *LED Indication Table*

| Counter Value | LEDs | | | |
|---|---|---|---|---|
| | Power On (Green) | Machine Busy (Green) | Document in Place (Green) | Error (Red) |
| 0 | — | — | — | — |
| 1 | — | — | — | On |
| 2 | — | — | On | — |
| 3 | — | — | On | On |
| 4 | — | On | — | — |
| 5 | — | On | — | On |
| 6 | — | On | On | — |
| 7 | — | On | On | On |
| 8 | On | — | — | — |
| 9 | On | — | — | On |

On: LED on —: LED off

Use the rotary switch to select a digit of the counter. The value of the selected digit is indicated by a combination of the four LEDs. For the LEDs, “ON” represents a 1 and “OFF” represents a 0. The four LEDs are read off as a four-bit number.



**Example:**

Rotary switch no LED condition

| | | | |
|---|---|---|---|
| 1 (units) | (ON, OFF, OFF, OFF) | = 1000 | = 8 |
| 2 (tens) | (OFF, OFF, ON, ON) | = 0011 | = 3 |
| 3 (hundreds) | (OFF, ON, OFF, ON) | = 0101 | = 5 |
| 4 to 7 | (OFF, OFF, OFF, OFF) | = 0000 | |

>>> Total counter value = 538 sheets

# 4.2 LEDs/TEST POINTS

## 4.2.1 LEDs

***SCU/LEDs***

| Number | Monitored Signal |
|---|---|
| LED1 | +5VS |
| LED2 | +5VE |
| LED3 | CPU clock |

## 4.2.2 TEST POINTS

***ADU***

| Number | Monitored Signal |
|---|---|
| TP301 | +24 V |
| TP302 | –12 V |
| TP303 | +12 V |
| TP304 | COM |
| TP305 | +5VE |
| TP308 | +5VS |
| TP309 | COM |

# 4.3 SPECIAL TOOLS

| Part Number | Part Name |
|---|---|
| A0069104 | Scanner Positioning Pin (4 pcs/set) |
| G4049003 | RS-13 Chart (A5) |
| G4049005 | RS-13 Chart (A4) |
| G4049004 | RS-13 Chart (A3, 55 kg) |
| G4049006 | RS-13 Chart (A3, 90 kg) |
| H2039114 | RS-12 Chart (A3) |

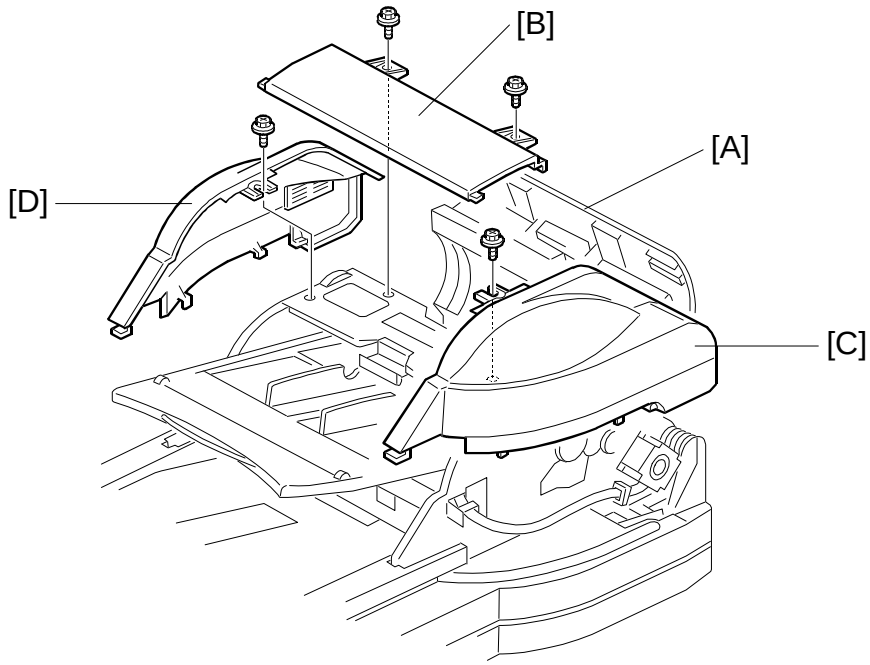
# 5. REPLACEMENT AND ADJUSTMENT

**⚠CAUTION**

**Before starting disassembly, be sure to turn off the main switch and disconnect the power cord and interface cable(s) for safety.**

## 5.1 COVERS

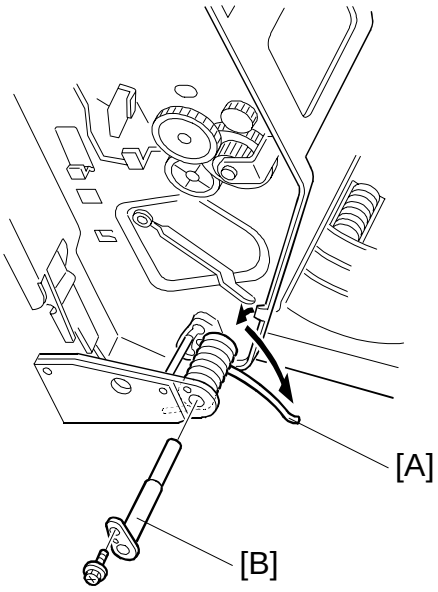
### 5.1.1 ADF EXTERIOR



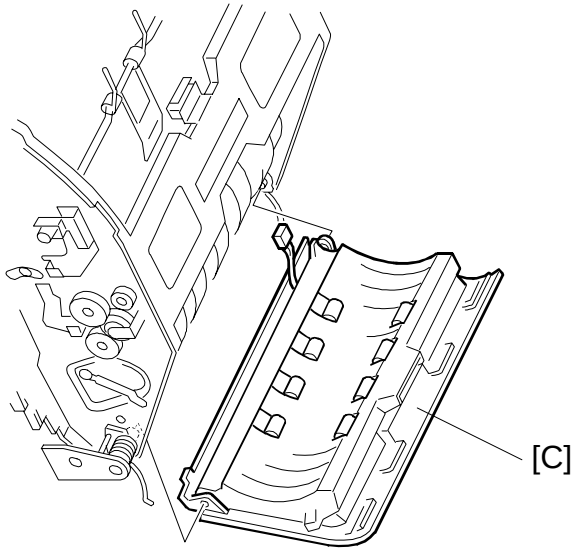

G411R500.WMF

1. Open the ADF cover [A].
2. Remove the ADF upper cover [B] (2 screws).
3. Remove the ADF right cover [C] (1 screw).
   **NOTE:** Remove the ADF right cover by carefully lifting it from the rear.
4. Remove the ADF left cover [D] (1 screw).

## 5.1.2 ADF COVER



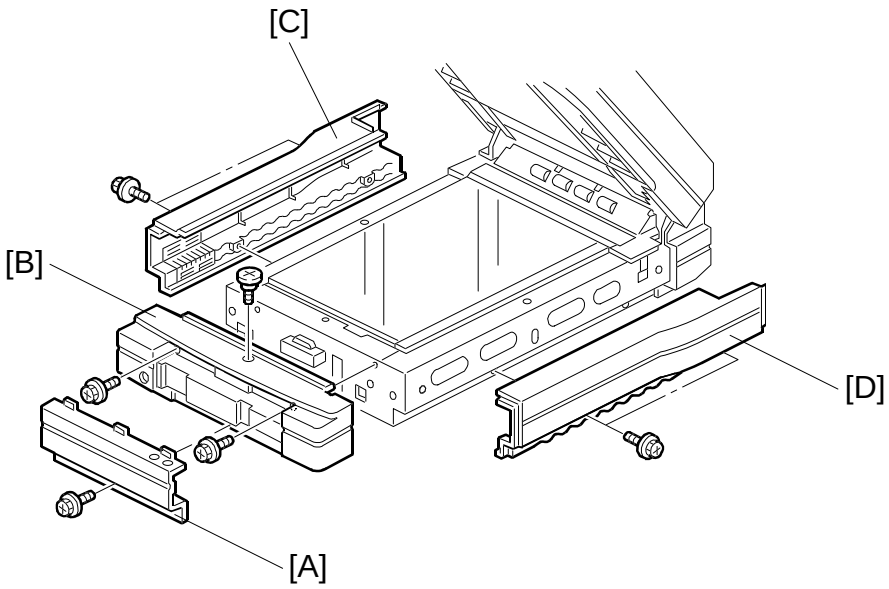

G411R501.WMF



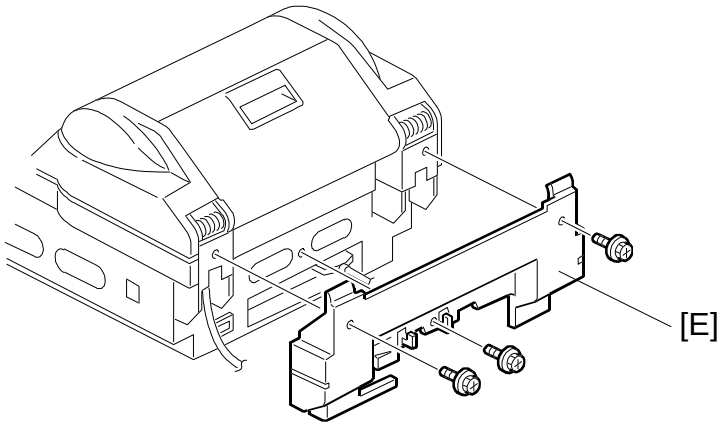

G411R502.WMF

1. Remove the ADF upper and ADF right cover (see ADF Exterior).
2. Remove the rear cover (see Scanner Exterior/Operation Panel).
3. Open the platen cover vertically (see Exposure Glass).
4. Remove the spring [A].
5. Remove the pin [B] (1 screw).
6. Remove the ADF cover [C] (1 connector).

## 5.1.3 SCANNER EXTERIOR/OPERATION PANEL




G411R503.WMF



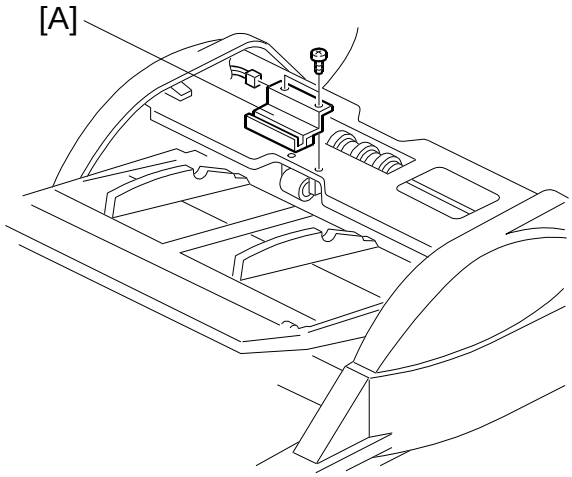

G411R504.WMF



1. Remove the operation panel [A] (1 screw).
2. Remove the front cover [B] (3 screws).
3. Remove the left cover [C] (2 screws).
4. Remove the right cover [D] (2 screws).
5. Remove the rear cover [E] (3 screws).

# 5.2 ADF AND UPPER SIDE

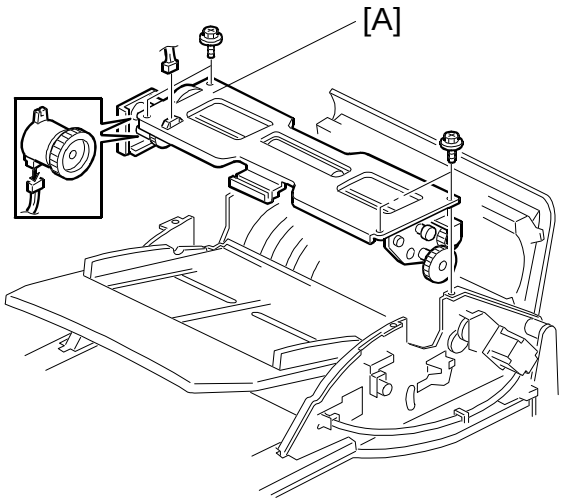
## 5.2.1 DOCUMENT SENSOR




G411R505.WMF

1. Remove the ADF upper cover (see ADF Exterior).
2. Remove the document sensor [A] (1 connector, 2 screws).

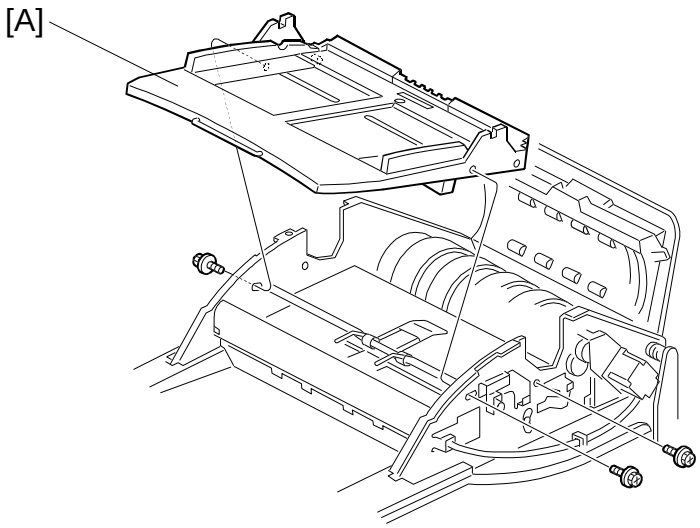
## 5.2.2 SEPARATION UNIT




G411R506.WMF

1. Remove the ADF upper, ADF left, and ADF right cover (see ADF Exterior).
2. Remove the separation unit [A] (3 connectors, 4 screws).

## 5.2.3 DOCUMENT TABLE ASSEMBLY

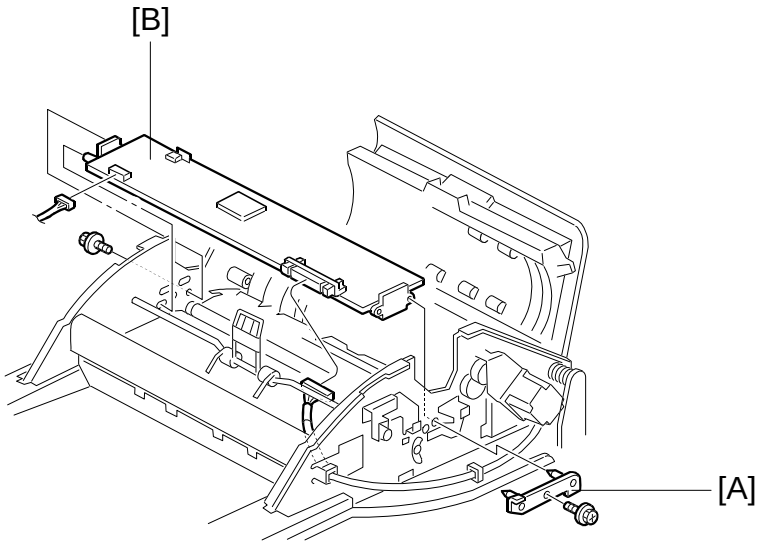



G411R507.WMF

1. Remove the separation unit (See Separation Unit).
2. Remove the document table assembly [A] (3 screws).



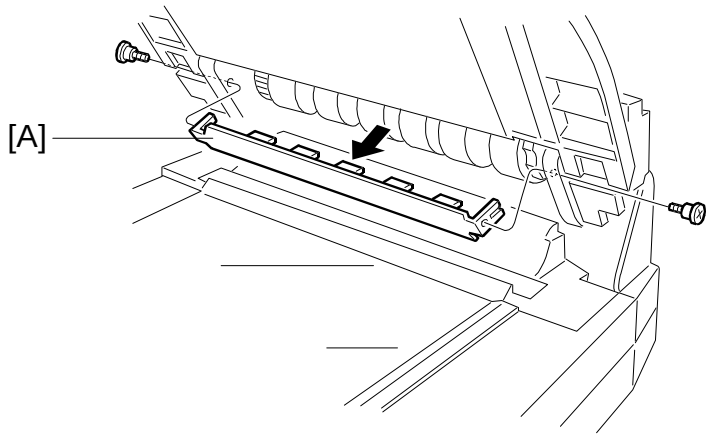
## 5.2.4 CIS




G411R508.WMF

1. Remove the document table assembly (See Document Table Assembly).
2. Remove the stopper bracket [A] (1 screw).
3. Remove the ADU (See ADU/Paper Transport Motor).
4. Remove the CIS [B] (2 connectors, 1 screw).

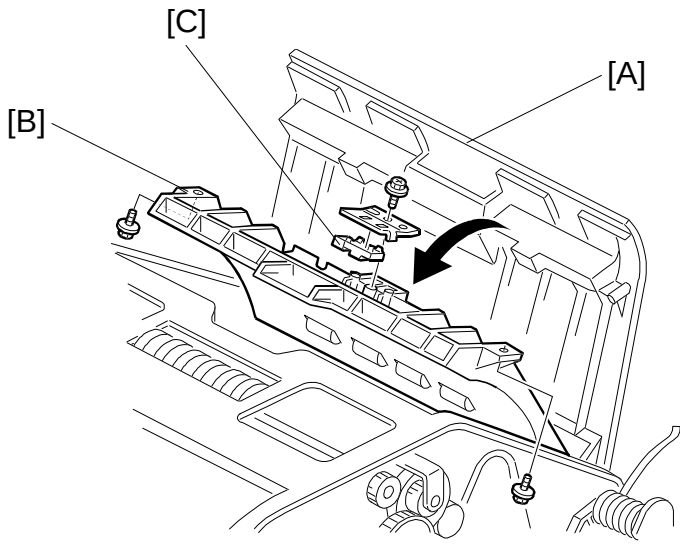
## 5.2.5 SCANNING GUIDE PLATE




G411R509.WMF

1. Remove the ADF upper, ADF left, and ADF right cover (See ADF Exterior).
2. Remove the scanning guide plate [A] (2 screws).

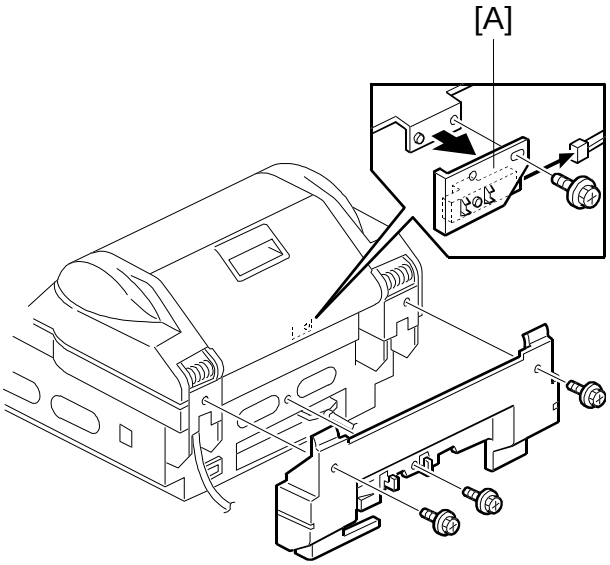
## 5.2.6 FEED SENSOR




G411R510.WMF

1. Open the ADF cover [A].
2. Remove the feed cover [B] (2 screws).
3. Remove the feed sensor [C] (1 connector, 1 screw).

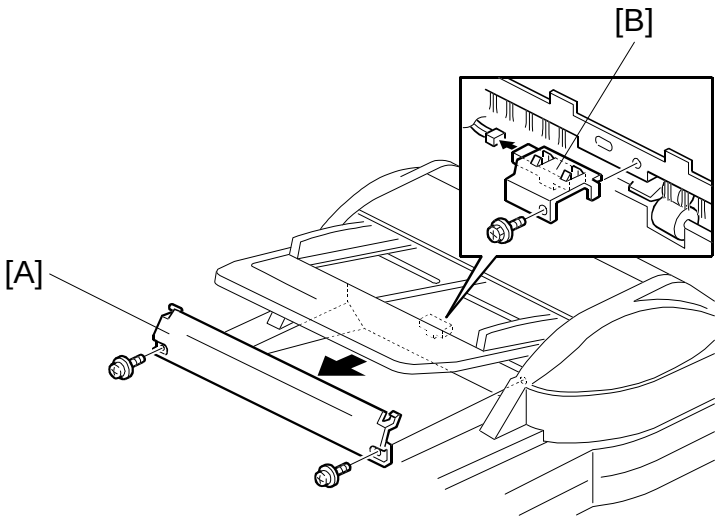
## 5.2.7 READ SENSOR




G411R511.WMF

1. Remove the rear cover (See Scanner Exterior/Operation Panel).
2. Remove the read sensor [A] (1 connector, 1 screw).

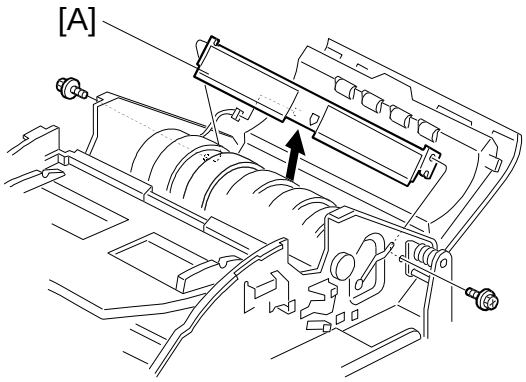
## 5.2.8 FEED-OUT SENSOR



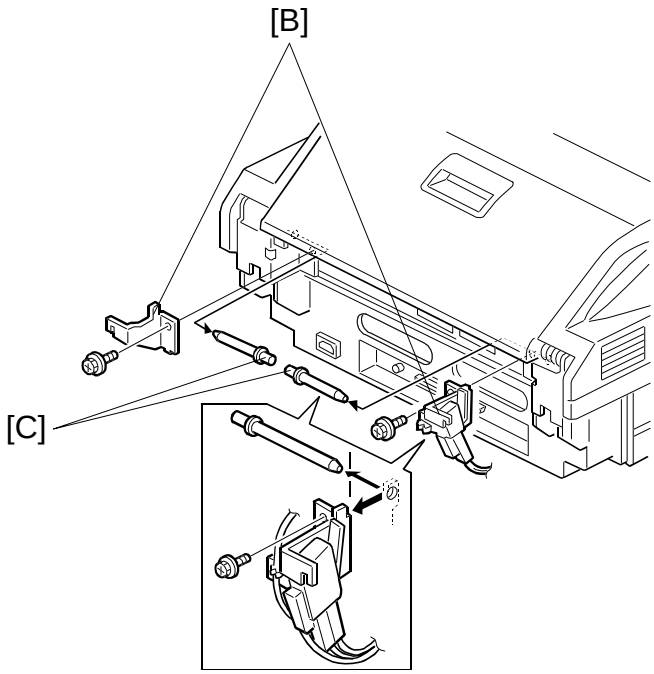

G411R512.WMF

1. Remove the feed-out cover [A] (2 screws).
2. Remove the feed-out sensor [B] (1 connector, 1 screw).

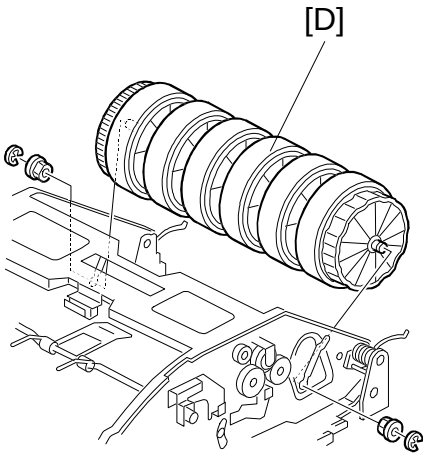
## 5.2.9 PAPER TRANSPORT DRUM




G411R513.WMF




G411R514.WMF

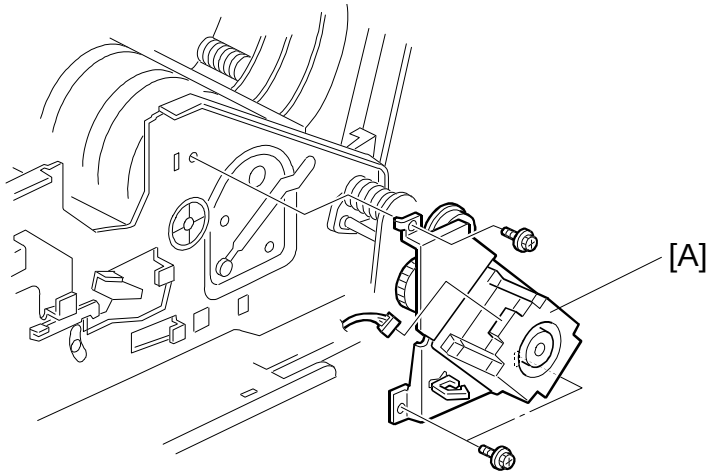



G411R515.WMF

1. Remove the separation unit (see Separation Unit).
2. Remove the paper feed motor (see Paper Feed Motor).
3. Remove the ADU (see ADU/Paper Transport Motor).
4. Remove the paper transport motor (see ADU/Paper Transport Motor).
5. Remove the registration guide plate [A] (1 connector, 2 screws).
6. Remove the rear cover (see Scanner Exterior/Operation Panel).
7. Remove the stopper brackets [B] (1 screw each).
8. Remove the pins [C].
9. Open the ADF cover.
10. Remove the paper transport drum [D] (2 E-rings, 2 bearings).

# 5.3 ADF AND RIGHT SIDE

## 5.3.1 PAPER FEED MOTOR

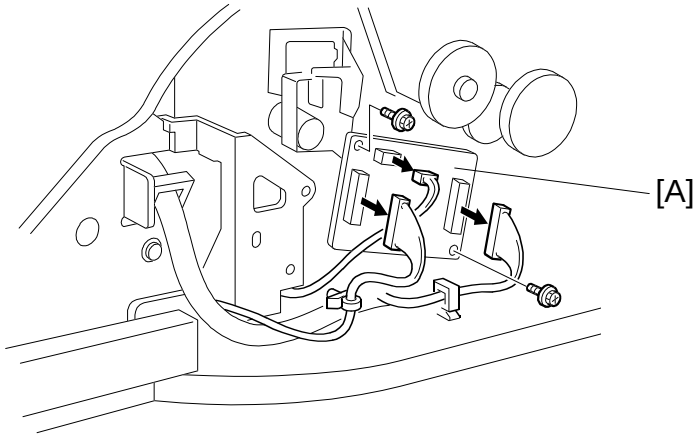



G411R516.WMF

1. Remove the ADF upper and ADF right cover (see ADF Exterior).
2. Remove the paper feed motor [A] (1 connector, 3 screws).



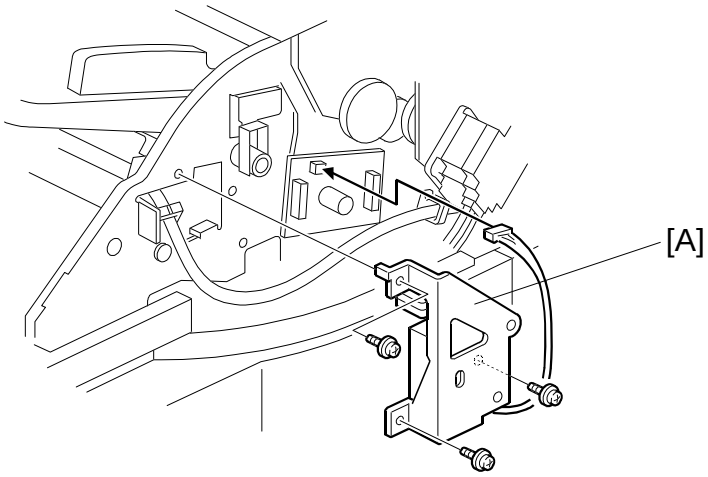
## 5.3.2 EDU




G411R517.WMF

1. Remove the ADF upper and ADF right cover (see ADF Exterior).
2. Remove the EDU [A] (3 connectors, 2 screws).

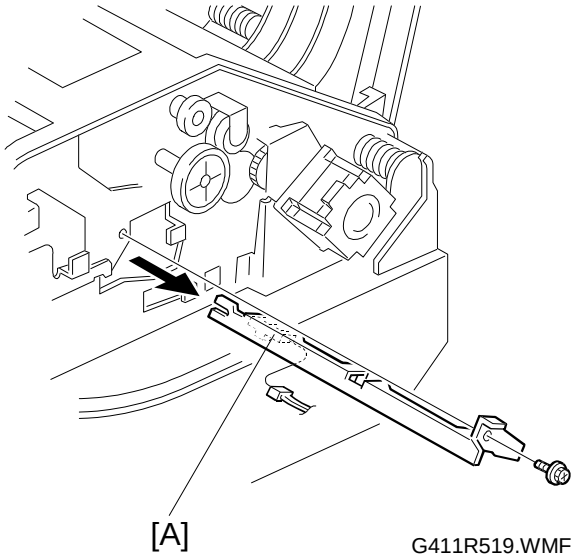
## 5.3.3 ENDORSER SOLENOID




G411R518.WMF

1. Remove the ADF upper and ADF right cover (see ADF Exterior).
2. Remove the endorser solenoid [A] (1 connector, 3 screws).

## 5.3.4 RELAY SENSOR

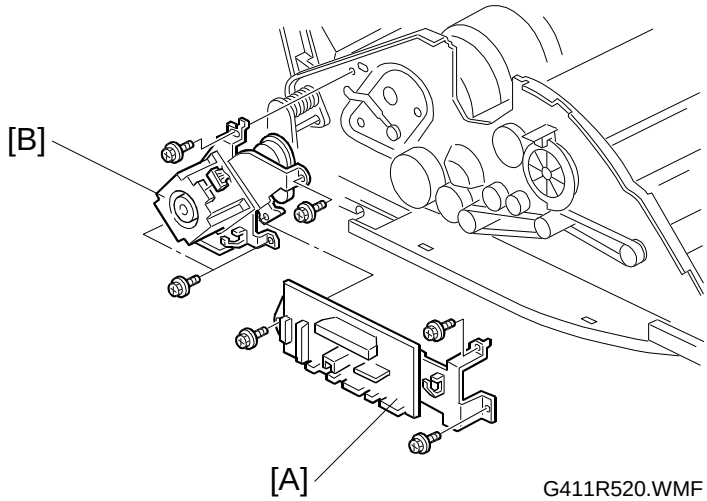



G411R519.WMF

1. Remove the ADF upper and ADF right cover (see ADF Exterior).
2. Remove the relay sensor [A] (1 connector, 1 screw).

# 5.4 ADF AND LEFT SIDE

## 5.4.1 ADU/PAPER TRANSPORT MOTOR

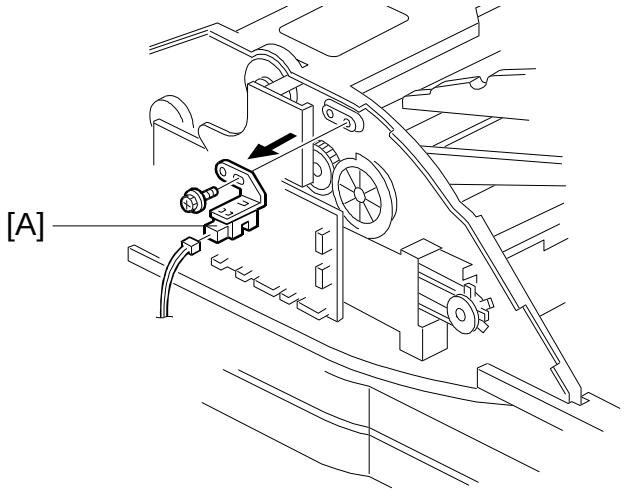



G411R520.WMF

1. Remove the ADF upper and ADF left cover (see ADF Exterior).
2. Remove the ADU [A] (10 connectors, 3 screws).
3. Remove the paper transport motor [B] (1 connector, 3 screws).



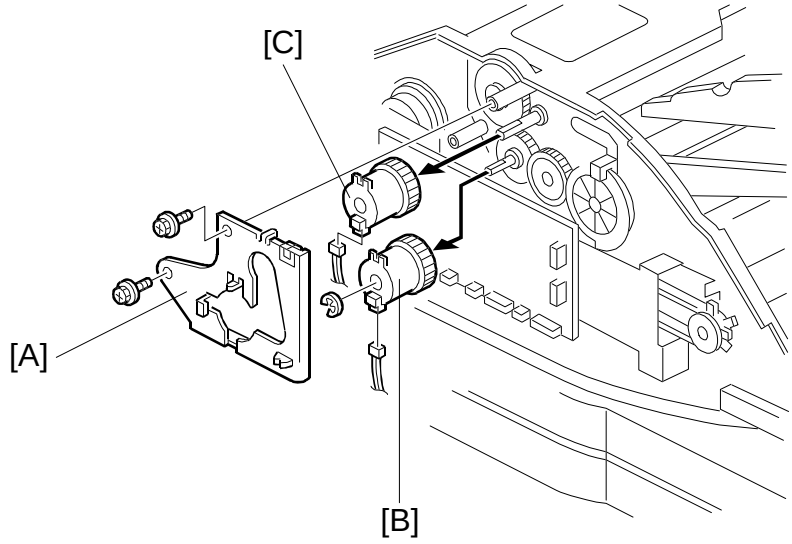
## 5.4.2 DOCUMENT TABLE POSITION SENSOR




G411R521.WMF

1. Remove the ADF upper and ADF left cover (see ADF Exterior).
2. Remove the document table position sensor [A] (1 connector, 1 screw).

## 5.4.3 PICK-UP CLUTCH/DOCUMENT TABLE LIFT CLUTCH

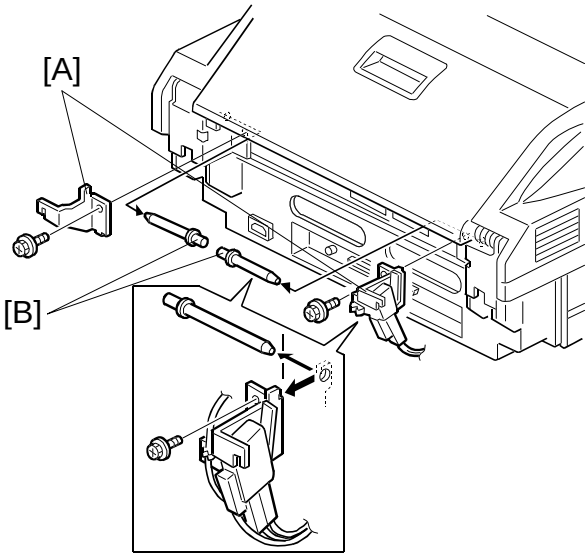



G411R522.WMF

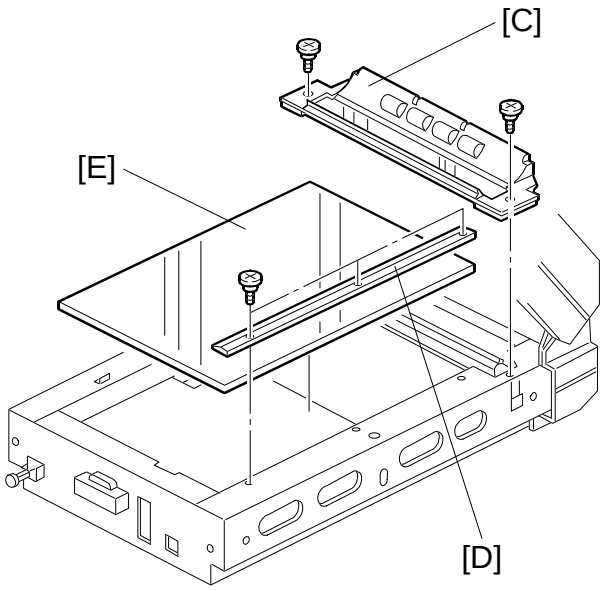
1. Remove the ADF upper and ADF left cover (see ADF Exterior).
2. Remove the stopper bracket [A] (2 screws).
3. Remove the pick-up clutch [B] (1 connector).
4. Remove the document table lift clutch [C] (1 connector, 1 E-ring).

# 5.5 SCANNER

## 5.5.1 EXPOSURE GLASS



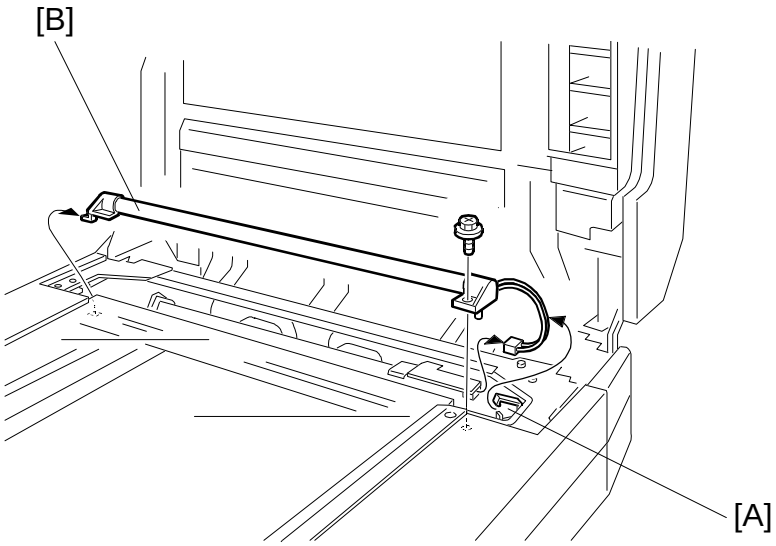

G411R514.WMF




G411R523.WMF

1. Remove the rear cover (See Scanner Exterior/Operation Panel).
2. Remove the stopper brackets [A] (2 screws).
3. Remove the pins [B].
4. Open the platen cover vertically.
5. Remove the lamp cover [C] (2 screws).
6. Remove the scale [D] (3 screws).
7. Remove the exposure glass [E].

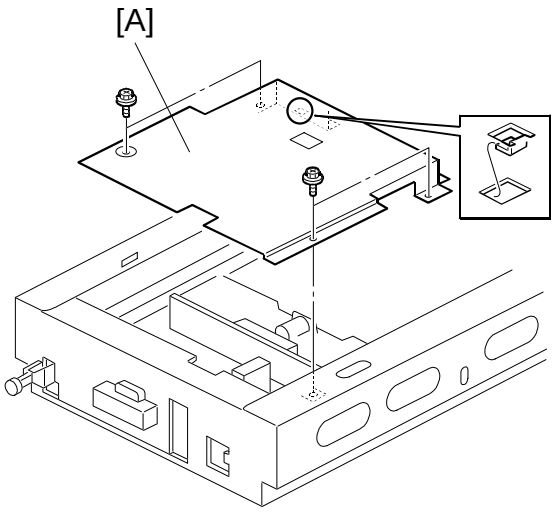
## 5.5.2 EXPOSURE LAMP



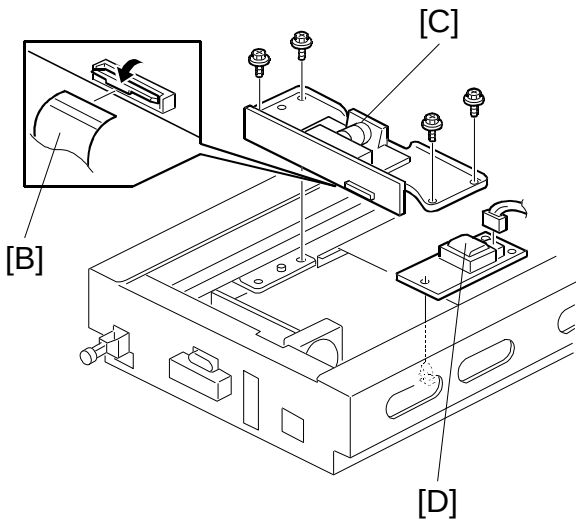

G411R524.WMF

1. Remove the exposure glass (see Exposure Glass).
2. Slide the 1st scanner to the cutout [A] in the right frame.
3. Remove the exposure lamp [B] (1 connector, 1 screw).

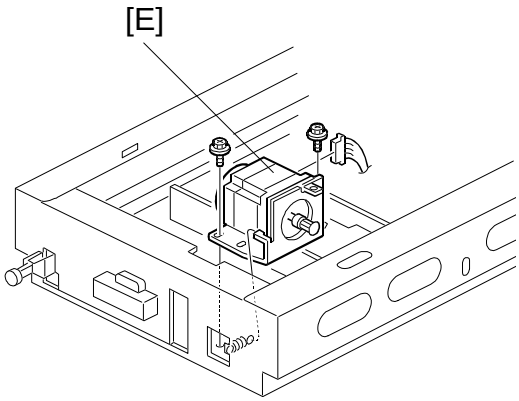
## 5.5.3 SBU/LAMP STABILIZER/SCANNER MOTOR/PSU



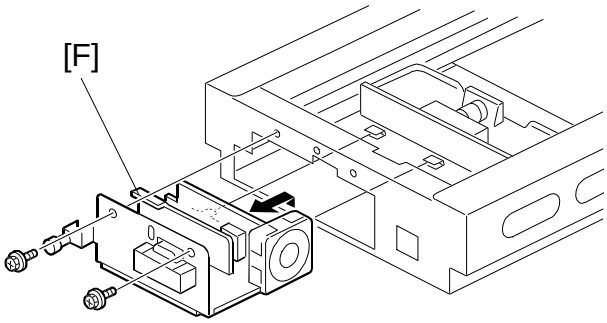

G411R525.WMF




G411R526.WMF



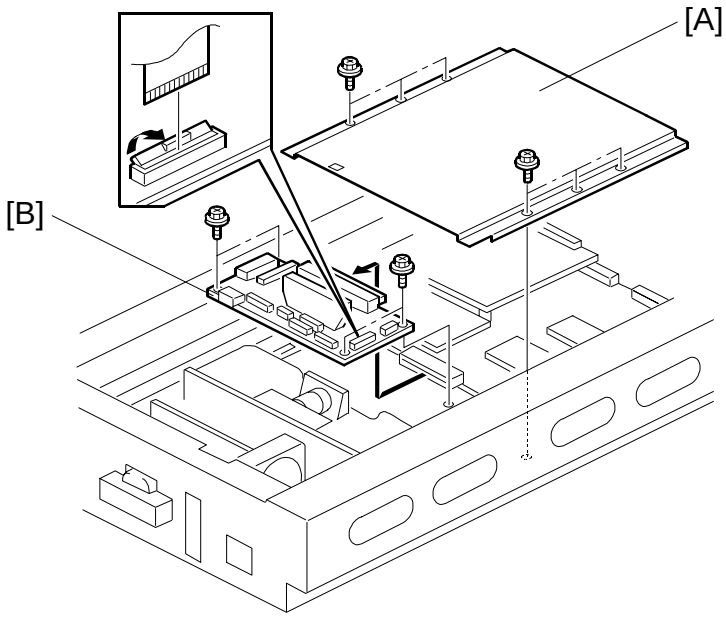

G411R527.WMF




G411R528.WMF

1. Remove the exposure glass (see Exposure Glass).
2. Remove the lens cover [A] (4 screws).
3. Disconnect the flexible cable [B]
4. Remove the SBU [C] (4 screws).
5. Remove the lamp stabilizer [D] (2 connectors).
6. Remove the operation panel (see Scanner Exterior/Operation Panel).
7. Remove the front cover (see Scanner Exterior/Operation Panel).
8. Remove the scanner motor [E] (1 spring, 1 connector, 2 screws).
9. Remove the PSU [F] (5 connectors, 2 screws).

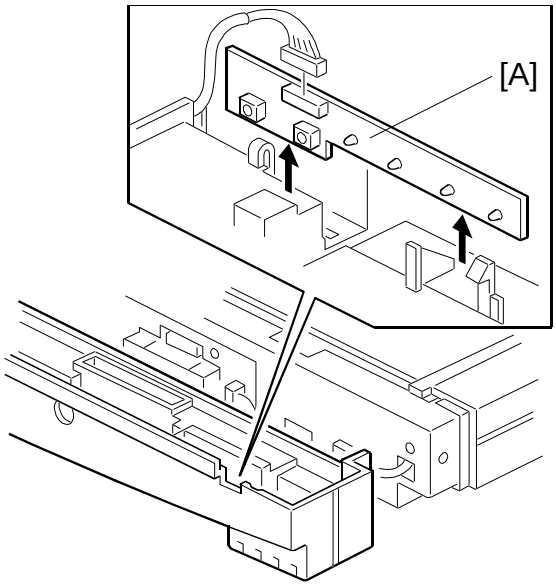
## 5.5.4 IOB




G411R529.WMF

1. Remove the exposure glass (see Exposure Glass).
2. Remove the lens cover (see SBU/Lamp Stabilizer/Scanner Motor/PSU).
3. Remove the PCB cover [A] (6 screws).
4. Remove the IOB [B] (5 connectors, 4 screws).

## 5.5.5 SOP

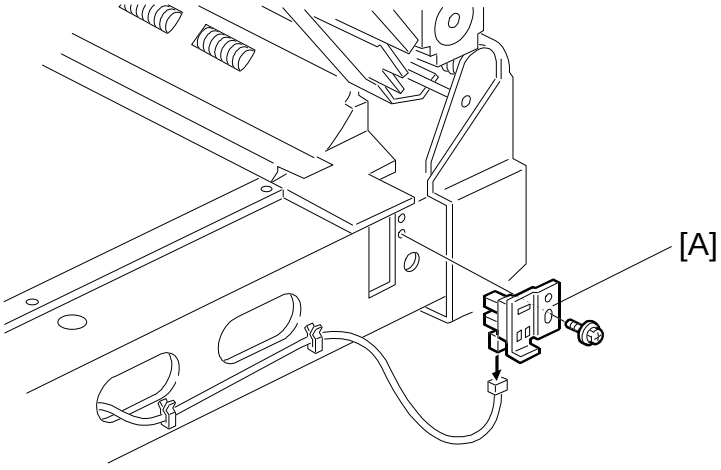



G411R538.WMF

1. Remove the operation panel and the front cover (see Scanner Exterior/Operation Panel).
2. Remove the SOP (1 connector).



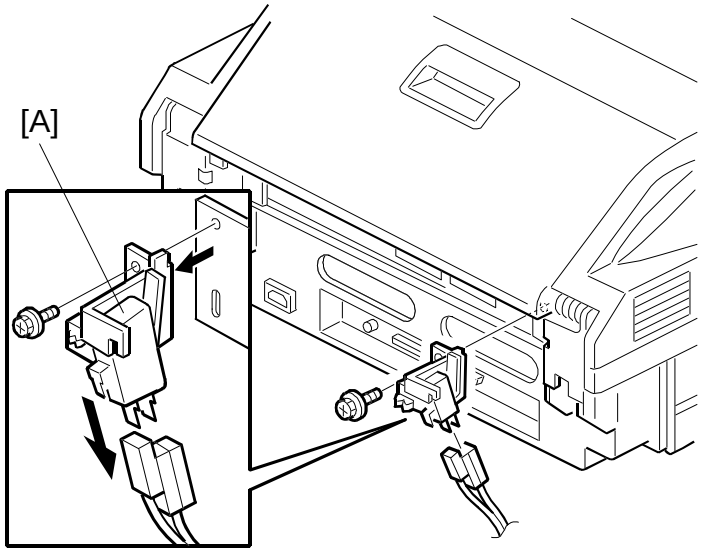
## 5.5.6 HOME POSITION SENSOR




G411R530.WMF

1. Remove the right cover (see Scanner Exterior/Operation Panel).
2. Remove the home position sensor [A] (1 connector, 1 screw).

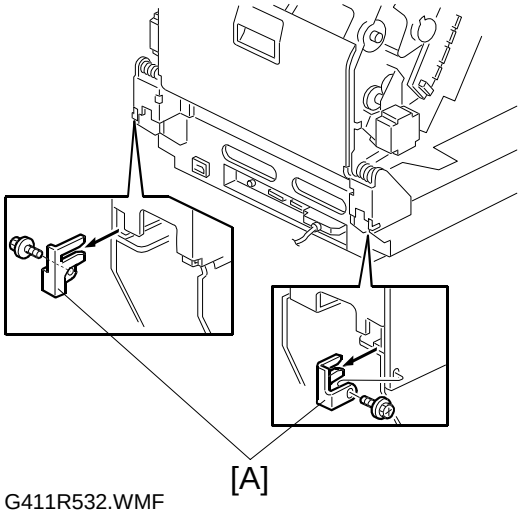
## 5.5.7 ADF INTERLOCK SWITCH



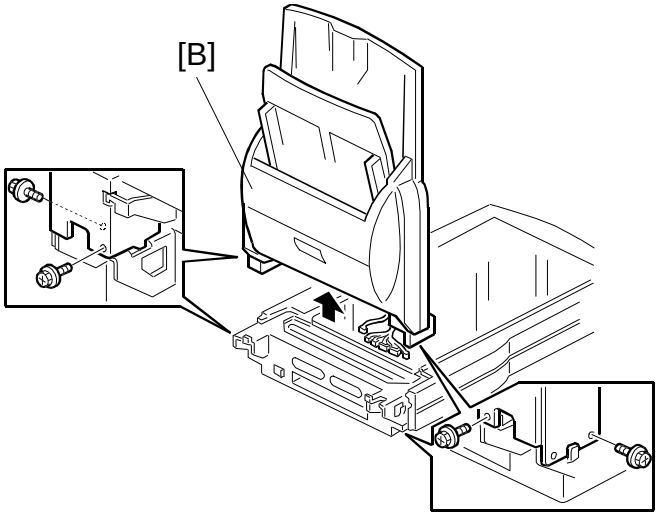

G411R531.WMF

1. Remove the rear cover (see Scanner Exterior/Operation Panel).
2. Remove the ADF interlock switch [A] (1 connector, 1 screw).

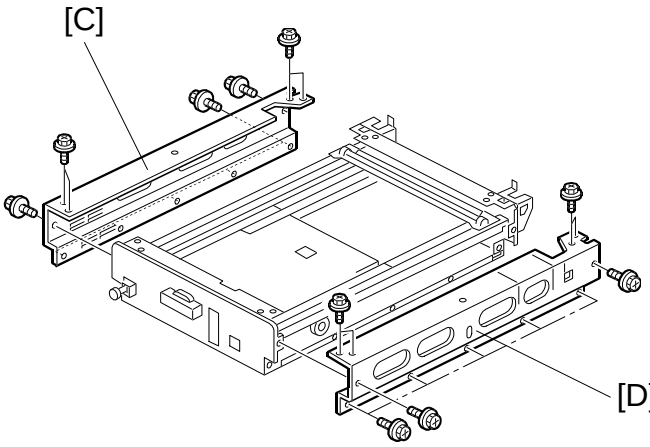
## 5.5.8 SCANNER WIRE




G411R532.WMF

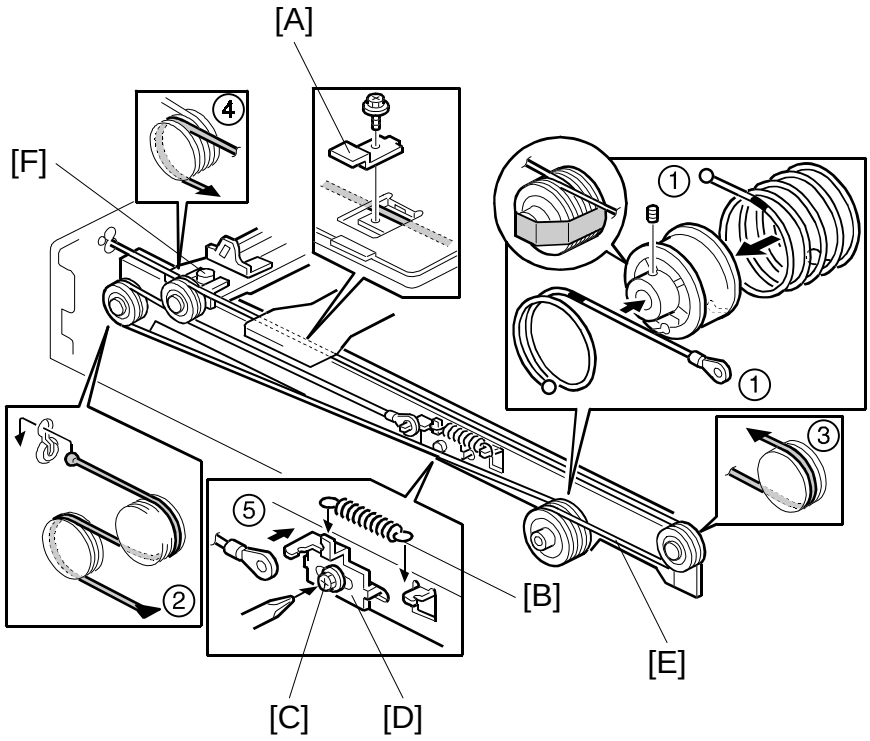



G411R533.WMF



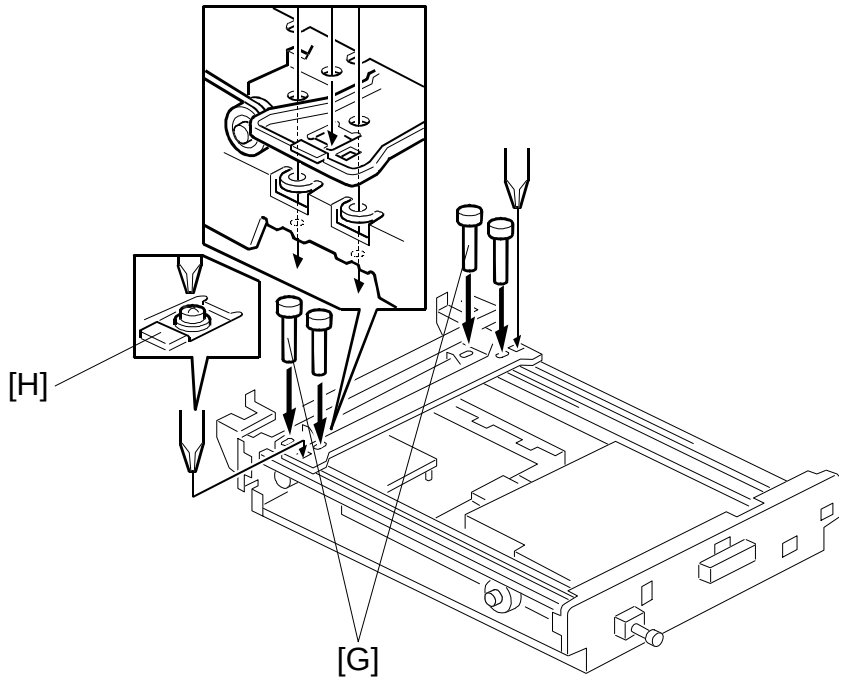

G411R534.WMF

1. Remove the exposure glass (see Exposure Glass).
2. Remove the stopper brackets [A] (1 screw each).
3. Remove the ADF [B] (4 connectors, 4 screws).
4. Remove the operation panel, front cover, right cover, and left cover (see Scanner Exterior/Operation Panel).
5. Remove the left frame [C] (11 screws).
6. Remove the right frame [D] (11 screws).




G411R536.WMF

7. Remove the right and left scanner wire brackets [A] (1 screw each). Then, remove the 1st scanner.
8. Remove the tension spring [B].
9. Loosen the screw [C] securing the wire tension bracket [D].
10. Remove the scanner wire [E].
11. Secure the 2nd scanner with the scanner positioning tools (P/N A0069104) [F].
12. Wind the new scanner wire around the scanner drive pulley in the correct direction, as shown (①).
13. Wind the end of the new wire with the ball as shown (②).
14. Wind the end of the new wire with the ring as shown (③, ④ and ⑤).
15. Wind the new scanner wire for the other side as well.
16. Install the tension spring [B] on the wire tension bracket [D].
17. Tighten the wire tension bracket [D].



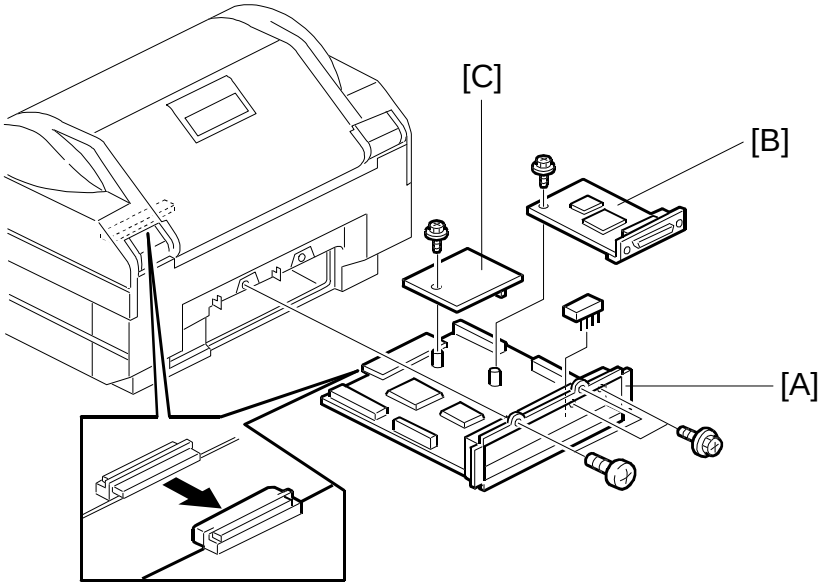

G411R535.WMF



18. Install the 1st scanner and adjust its position with the scanner positioning tools (P/N A0069104) [G].
19. Secure the 1st scanner with the scanner wire bracket [H] (1 screw each).
20. Remove the positioning tools. After sliding the scanner to the front and back several times, set the positioning tools to check the scanner wire bracket and tension bracket again.
21. Reassemble the scanner.

# 5.6 PCB

## 5.6.1 SCU/RCU/IPU

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1. Remove the SCU assembly [A] (2 screws).
2. Remove the RCU [B] (3 screws).
3. Remove the IPU [C] (1 screw).

**NOTE:** When replacing the SCU, put the old ROM (IC31) on the new SCU.

# 6. TROUBLESHOOTING

## 6.1 SELF-DIAGNOSTICS

The scanner automatically performs a series of self-diagnostic checks each time the power is turned on. If an error is detected, it is displays the type of error using the four LEDs on the scanner. See “Detailed Section Descriptions - Initialization” for more details of the initialization procedure.

## 6.2 CHECK ITEMS

### 6.2.1 ITEMS CHECKED DURING INITIALIZATION

The self-diagnostics check the following items at power-up.

1) The ADF or ADF cover is not closed properly.
2) An original is jammed in the ADF.
3) There is a problem with the operation of the document table.
4) Memory error (system error)
   Does the memory in the scanner work properly?
5) Home position error (system error)
   Have the scanners reached home position properly?
6) Exposure lamp error (system error)
   Is the standard white level detected properly?

**NOTE:**
- If an error is detected for any of items 4) to 6), “System Error” is indicated, and the details can be checked with the self-diagnostics (see section 6-3).
- Even if an error is detected for item 2), scanning can start in book mode.

# 6.3 ERROR INDICATION

If the self-diagnostics find an error, the error is displayed by a combination of the four LEDs on the scanner. If the dip switches on the rear of the machine are set up for normal operation, the error is indicated roughly for users. When the dip switches are set to the self-diagnostic mode position, the system error is indicated in detail for technicians.

## 6.3.1 USER LEVEL ERROR INDICATION

| Conditions | Contents | Originals on the table | LEDs | | | |
|---|---|---|---|---|---|---|
| | | | Green | Green | Green | Red |
| Machine Initialization | Overall machine check | | On | On | On | On |
| Demonstration Mode | | | On | On | On | On |
| Stand-by | Normal mode | No | On | Off | Off | Off |
| | | Yes | On | Off | On | Off |
| | Scan wait mode | No | On | Off | Blinking | Off |
| | | Yes | On | Off | Blinking | Off |
| Scanning | Normal mode | No | On | On | Off | Off |
| | | Yes | On | On | On | Off |
| User-visible Error Conditions | ADF cover switch open | | On | Off | Off | On |
| | Document jam | | On | Off | Blinking | On |
| | Document misfeed | | On | Off | On | On |
| | Document table error | | On | Off | Blinking | Blinking |
| | Endorser error | | Blinking | Blinking | On | Off |
| System Error | | | Blinking | Blinking | Blinking | Blinking |

On: LED on Blinking: LED blinking Off: LED off

## 6.3.2 TECHNICIAN LEVEL ERROR INDICATION

| Error Items | LEDs | | | |
|---|---|---|---|---|
| | Green | Green | Green | Red |
| Memory error (Simplex) | Blinking | Off | Off | Off |
| Memory error (Duplex) | Off | Blinking | Off | Off |
| Exposure lamp failure | Blinking | Blinking | On | On |
| CIS error | Blinking | Blinking | On | Blinking |
| White level error | Blinking | Blinking | Off | Off |
| Home position error | Blinking | Blinking | Blinking | On |
| SCU error | Blinking | Off | Off | Blinking |
| RCU error | Blinking | Off | On | Blinking |
| Optional IPU error | Blinking | On | Off | Blinking |

On: LED on Blinking: LED blinking Off: LED off

# 6.4 TROUBLESHOOTING PROCEDURES

There are two types of troubleshooting procedure.

- For user-visible error conditions that the user could not clear up
- For technician level error conditions

## 6.4.1 USER-VISIBLE ERROR CONDITIONS

### *ADF Interlock Switch Open*

**Symptom:**

The problem cannot be solved with the procedures in the user's manual.

**Possible Causes:**

- Defective ADF interlock switch
- Damaged cable between the ADF interlock switch and the PSU

**Procedure:**

Does 24 volts come to the ADF cover interlock switch?
Yes No
Is the cable damaged?
Yes No
Replace the PSU.
Replace the cable.
Replace the ADF interlock switch.

### *Document Jam*

**Symptom:**

The problem cannot be solved with the procedures in the user's manual.

**Possible Causes:**

- Damaged separation unit
- Damaged paper transport drum assy
- Damaged paper feed-out unit
- Defective paper transport motor or paper feed motor
- Defective read sensor or feed-out sensor
- Defective SCU, IOB or ADU

**Procedure:**

First of all, check the sensors with demonstration and sensor check mode. See Service Level Functions – Dip Switch Settings.

Are all the sensors OK?
Yes No
Is the cable damaged?
Yes No
Replace the sensor.
Replace the cable.
Does the jam always happen at the same position?
Yes No
Are the 24-volt lines from the PSU to the IOB (24VADU) or from the IOB to the ADF OK?
Yes No
Is the cable damaged?
Yes No
Replace the PSU.
Replace the cable.
Is the 24-volt line from the ADU to the paper transport motor OK?
Yes No
Is the cable damaged?
Yes No
Replace the ADU.
Replace the cable.
Replace the paper transport motor.

**NOTE:** If the feed motor is defective, a "Document Table Error" is generated.

Did the jam occur at the paper transport drum assy?
Yes No
Replace the paper feed-out assy.
Replace the paper transport drum assy.

### *Paper Misfeed*

**Symptom:**

The problem cannot be solved with the procedures in the user's manual.

**Possible Causes:**

- Damaged separation unit
- Defective pick-up clutch
- Defective ADU
- Defective SCU
- Defective feed sensor

**Procedure:**

Does the pick-up roller mechanism work?
Yes No
Is 24 volts supplied to the pick-up clutch?
Yes No
Is the cable damaged?
Yes No
Replace the ADU.
Replace the cable.
Is there an open circuit in the clutch?
Yes No
Replace the SCU.
Replace the pick-up clutch.
Does the jam happen at the separation unit?
Yes No
Replace the pick-up roller.
Replace the separation unit.

### *Document Table Error*

**Symptom:**

The problem cannot be solved with the procedures in the user's manual.

**Possible Causes:**

- Defective document table position sensor
- Defective document table clutch
- Defective paper feed motor
- Defective ADU
- Defective SCU
- Damaged document table

**Procedure:**

Is the document table itself OK?
Yes — No
Replace it.
Does the table work (up/down operation)?
Yes — No
Does the separation roller mechanism work?
Yes — No
Does 24 volts come to the paper feed motor?
Yes — No
Is the cable damaged?
Yes — No
Replace the ADU.
If the 24 volts from the PSU is defective, another error will be generated.
Replace the cable.
Replace the motor, if it has a defective.
Does the document table lift clutch work.
Yes — No
Does 24 volts come to the document table lift clutch?
Yes — No
Is the cable damaged?
Yes — No
Replace the ADU
Replace the cable.
Replace the document table lift clutch
Check the table lift mechanism.
Replace the SCU.

**NOTE:** If the 5-volt line is defective, the ADF LEDs will not work, so the error type will not be visible. Therefore it can be assumed that there is a problem with a timing signal. All timing signals are generated in the SCU and the problem can be fixed by replacing the SCU.

### *Endorser Error*

**Symptom:**

The problem cannot be solved with the procedures in the user's manual.

**Possible Causes:**

- Defective endorser unit
- Defective EDU

**Procedure:**

Is the endorser unit is broken?
Yes No
Is the cable between the EDU and the endorser unit or the ADU and the EDU OK?
Yes No
Replace the cable.
Replace the EDU.
Replace the endorser unit.

## 6.4.2 SERVICE CALL ERRORS (SYSTEM ERRORS)

If a system error occurs, the following errors can be detected with the self-diagnostics using the dip switches. See Service Level Functions – Dip Switch Settings.

### *Memory Error*

**Symptom:**

This error occurs in the following conditions.

- SRAM read/write error
- DRAM read/write error
- Memory over run error

**Possible Cause:**

- Defective SCU

**Procedure:**

Replace the SCU.

### *Lamp Error*

**Symptom:**

The white level cannot be adjusted.

**Possible Cause:**

- A mirror is out of position.
- Misalignment
- Defective SBU
- Defective IOB
- Defective SCU

**Procedure:**

Does the exposure lamp light during scanning?
Yes No
Does 24 volts come to the lamp stabilizer?
Yes No
Is the cable damaged?
Yes No
Replace the PSU.
Replace the cable.
Replace the exposure lamp
Does the exposure lamp light?
Yes No
Replace the lamp stabilizer.
Go to the next step.
Are all mirrors installed properly?
Yes No
Reseat any mirrors that are out of place.
Does the SBU generate the correct signals?
Yes No
Replace the SBU.
Replace the SCU. If that does not work, try changing the IOB.



### *Document Table Error*

Same as for the user-visible error condition. See section 6-4-1.

### *CIS Error (duplex model only)*

**Symptom:**

The white level of the reverse side scanning cannot be adjusted.

**Possible Cause:**

- Defective CIS unit
- Defective ADU
- Defective RCU
- Defective SCU

**Procedure:**

Does the LED array light?
YES No
Does 15 volts come to the CIS unit?
Yes No
Is the cable damaged?
Yes No
Replace the ADU.
Replace the cable.
Replace the CIS unit.
Does the CIS generate the correct signals?
Yes No
Replace the CIS unit.
Does the RCU generate the correct signals?
Yes No
Replace the RCU.
Replace the SCU.

### *Shading Error*

**Symptoms:**

A shading error occurs when one of the following conditions occurs.

- The difference in black level cannot be adjusted.
- The black level cannot be adjusted.
- The white level cannot be adjusted.

**Possible Causes:**

- A mirror is out of position.
- Misalignment
- Defective SCU
- Defective SBU
- Defective exposure lamp
- Dirty white plate

**Procedure:**

Is there any problem with the exposure lamp?
Yes No
Is the white plate dirty?
Yes No
Are all the mirrors installed properly?
Yes No
Reseat the mirror.
Does the SBU generate the correct signals?
Yes No
Replace the optical unit.
Replace the SCU.
Replace the ADF exposure cover.
Replace the exposure lamp.

**NOTE:** The read signal goes to the SCU through the IOB, but the IOB does not do any image processing. Therefore the IOB probably does not have a problem. However, if the problem is not solved even after replacing the SCU, try changing the IOB.

### *Home Position Error*

**Symptom:**

This error is detected when the home position sensor cannot detect the first scanner.

**Possible Causes:**

- Defective scanner motor
- Damaged cable between the scanner motor and the IOB
- Defective IOB
- Defective home position sensor
- Damaged cable between the home position sensor and the IOB

**Procedure:**

Does the home position sensor work? Check it with sensor test mode. (See See Service Level Functions – Dip Switch Settings.)
Yes No
Does 5 volts reach the sensor?
Yes No
Is the cable between the home position sensor and the IOB OK?
Yes No
Replace the cable.
Replace the PSU.
Replace the sensor.
Is the drive wire OK?
Yes No
Replace it.
Does 24 volts reach the scanner motor?
Yes No
Is the cable between the motor and the IOB damaged?
Yes No
Replace the IOB.
Replace the cable.
Replace the scanner motor.

### *SCU Error*

**Symptom:**

3.3 volts generated on the SCU failed during scanning.

**Possible Cause:**

- Defective SCU

**Procedure:**

Replace the SCU.

### *RCU Error*

**Symptom:**

3.3 volts generated on the RCU failed during scanning.

**Possible Cause:**

- Defective RCU

**Procedure:**

Replace the RCU.

### *Optional IPU Error*

**Symptom:**

3.3 volts generated on the optional IPU board failed during scanning.

**Possible Cause:**

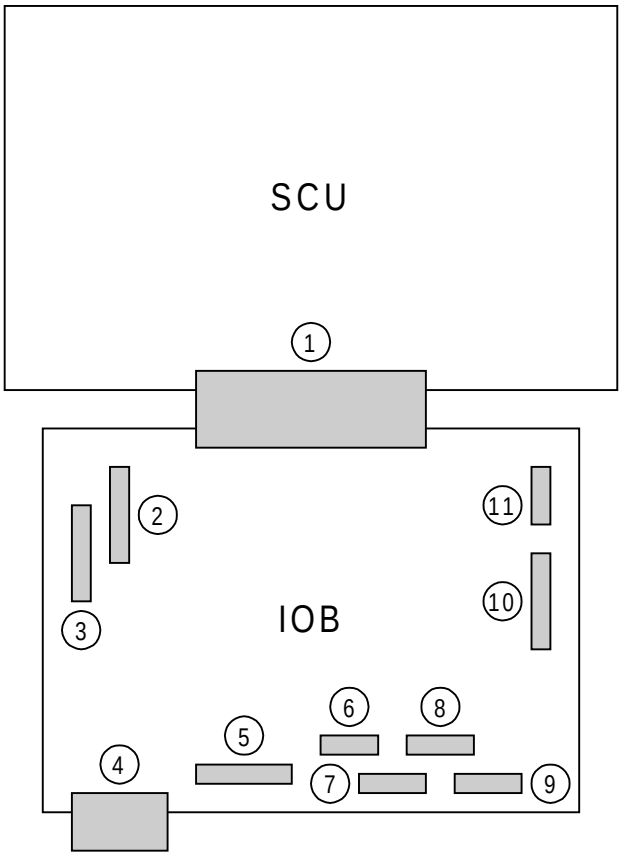
- Defective optional IPU board

**Procedure:**

Replace the optional IPU board.

# 6.5 INDICATION WHEN A CONNECTOR IS OUT OF POSITION

## 6.5.1 SCANNER

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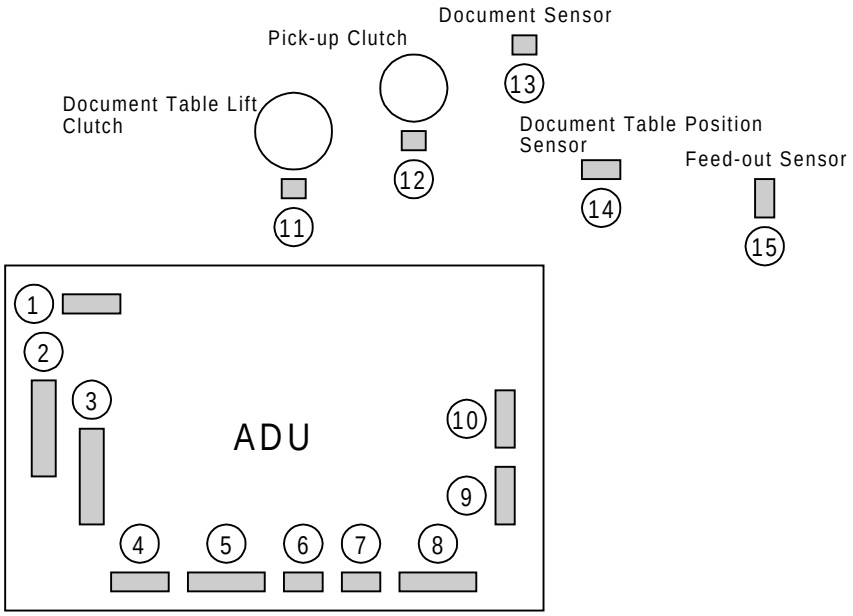
| Connector | Scanner LEDs | | | | Remarks |
|---|---|---|---|---|---|
| | Green | Green | Green | Red | |
| 1 (CN201) | — | — | — | — | |
| 2 (CN203) | On | Off | On | Off | |
| 3 (CN204) | On | Off | Blinking | Blinking | Document table error |
| 4 (CN210) | Blinking | Blinking | Blinking | Blinking | System error |
| 5 (CN209) | — | — | — | — | |
| 6 (CN211) | On | Off | Off | On | ADF interlock switch open |
| 7 (CN208) | — | — | — | — | |
| 8 (CN206) | Blinking | Blinking | Blinking | Blinking | System error |
| 9 | Not used | Not used | Not used | Not used | |
| 10 (CN202) | Blinking | Blinking | Blinking | Blinking | System error |
| 11 (CN205) | Blinking | Blinking | Blinking | Blinking | System error |

On: LED on Off: LED off Blinking: LED blinking

—: When the machine is switched on, all LEDs should light briefly. However, "—" in these tables indicates that the LED does not light up briefly at power-up.

## 6.5.2 ADF




G411T501.WMF

| Connector | Scanner LEDs | | | | Remarks |
|---|---|---|---|---|---|
| | Green | Green | Green | Red | |
| 1 (CN303) | On | Off | Off | Off | |
| 2 (CN302) | On | Off | Blinking | Blinking | Document table error |
| 3 (CN301) | On | Off | On | Off | |
| 4 (CN306) | On | Off | Off | Off | |
| 5 (CN305) | On | Off | Off | Off | |
| 6 (CN307) | On | Off | Blinking | Blinking | Document table error |
| 7 (CN310) | On | Off | Off | Off | |
| 8 (CN308) | On | Off | Off | Off | |
| 9 (CN309) | On | Off | Off | Off | |
| 10 (CN304) | On | Off | Blinking | Blinking | Document table error |
| 11 | On | Off | Blinking | Blinking | Document table error |
| 12 | On | Off | Off | Off | |
| 13 | On | Off | On | Off | |
| 14 | On | Off | Blinking | Blinking | Document table error |
| 15 | On | Off | Off | Off | |

On: LED on Off: LED off Blinking: LED blinking

—: When the machine is switched on, all LEDs should light briefly. However, "—" in these tables indicates that the LED does not light up briefly at power-up.

# 6.6 BLOWN FUSE CODITIONS

| Fuse | Rating | | Symptom when turning on the main switch |
|---|---|---|---|
| | **115 V** | **220 ~ 240 V** | |
| **Power Supply Unit** | | | |
| FU1 | 5 A/125 V | 3.15 A/250 V | No response. |
| FU31 | 4 A/125 V | | Exposure lamp error<br>Home position error<br>White level error |
| FU32 | 4 A/125 V | | Document table working error<br>Document jam |
| FU33 | 5 A/125 V | | No response. |
| FU35 | 5 A/125 V | | Exposure lamp error<br>RCU error |
| **ADU (Duplex Model)** | | | |
| FU101 | 1.25 A/250 V | | CIS error |
| **EDU** | | | |
| FU401 | 3.15 A/250 V | | Endorser error<br>Endorser does not work. |
| **Lamp Stabilizer** | | | |
| FU1 | 1 A/60 V | | Exposure lamp error |

# 7. OPTION

## 7.1 IPU (IMAGE PROCESSING UNIT)

### 7.1.1 OVERVIEW

The IPU does the following.

#### *Dynamic Threshold*

This function automatically determines a suitable threshold value based on the original, and converts the scanned image to binary data.

#### *Auto Photo/Letter*

This function automatically identifies the text portions of an original and the photographic portions, and scans each in a suitable scan mode.

#### *Document Size Detection*

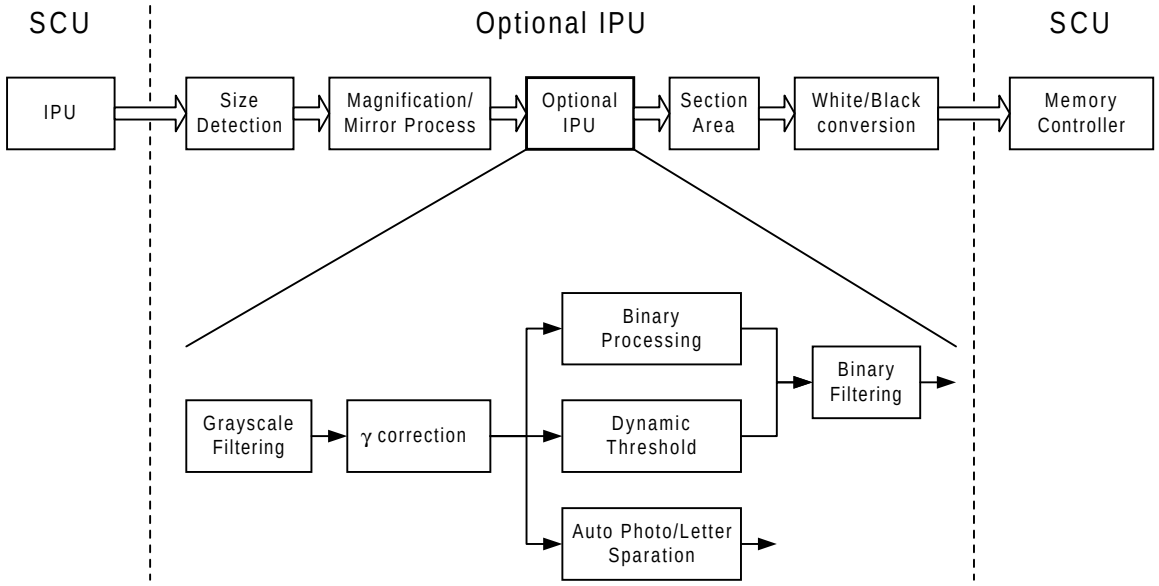
This function automatically detects the width of an original, and sends the information to the host computer.

#### *Section Area*

This function selects an area within an original and sets scanning conditions for that area.

# 7.2 IMAGE PROCESSING PATH

The following image processing is for the scanner with the optional IPU.




G411O500.WMF

### *Dynamic Threshold*

A suitable threshold value is determined based on the original.

### *Auto Photo/Letter Separation*

Generally, text areas have strong contrast between the image and the background. In photo areas, mid-range gray areas are common. By using these characteristics, the original image is separated into text and photo areas.

### *Section Area*

The original image is separated into specified areas. Each area is processed using the specified scanning mode.

### *Size Detection*

See Detailed Section Descriptions – Scanner Processes.

# HS2P (G407/G408/G410/G411) Point to Point Diagram